SPECIFICATIONS AND CONTRACT DOCUMENTS
FOR

SAN BERNARDINO COUNTY

Sheriff Scientific Investigations Division (SID) Orange and Blue Lab Renovation

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SELECTIVE DEMOLITION

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SCOPE OF WORK SUMMARY

A. Furnish all labor and equipment necessary to perform demolition and site clearing work as shown on drawings and specified herein, including removal of slabs, curbs, walls, partitions, fixtures, finishes, and other items as indicated and required for new construction.
B. Protect all existing installations from damage. Take measures to prevent damage to existing facilities and finishes during demolition and construction.
C. Carefully remove items which are to remain property of Owner, and store in secure, dry area for later reuse.
D. Salvaged Material (not wanted by Owner): Items which the Owner does not want and is of salvable value to Contractor may be removed from structure as work progresses. Owner and CBC 2016 require a minimum of 50% (by weight) of all non-hazardous construction materials be recycled, composted and/or salvaged.
E. Related Work Specified elsewhere:

1. Disconnecting and capping existing gas, water, sewer and electrical utilities is included under other Divisions. Coordinate with work under these Divisions to make sure their work is complete before starting demolition work affecting these utilities.
2. Removal of Plumbing: Division 22.
3. Removal of Mechanical: Division 23.
4. Removal of Electrical: Division 26.

1.03 STANDARDS AND REFERENCES

A. Definitions:
1. Except for items or materials indicated to be reused, salvaged or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from the site with further disposition by the Contractor(s) in a legal disposal area appropriate to the materials being disposed
2. "Remove": Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the Owner's property.
3. "Removed and salvaged": Items to remain the Owner's property shall be removed, cleaned, and packed or crated to protect against damage. Identify contents and deliver to Owner's designated storage area.
4. "Existing to Remain" Protect construction indicated to remain against damage and soiling during demolition. When permitted by the Architect, items may be removed to a suitable, protected storage location during demolition and then cleaned and reinstalled in their original locations.
5. "Remove and Reinstall": Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in locations indicated.

B. Codes and Regulations: Demolition work shall comply with local ordinances and Safety Codes of State of California and rules and regulations of Industrial Accident Commission of State of California' applicable to demolition work.

1.04 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Engage an experienced firm that has successfully completed demolition work similar to that indicated for this Project.
B. Safety Precautions: Perform demolition work in such a manner as to prevent damage to existing facilities to remain or to be salvaged, and to prevent injury to public and workmen engaged on site under this or other contracts.

1.05 SUBSTITUTIONS

Substitutions will be considered per Section 01 25 00 Substitution Procedures.

1.06 SUBMITTALS

A. Submit according to the requirements of Section 01 33 00 Submittal Procedures.
B. Proposed Dust Control Measures.
C. Proposed Noise Control Measures.
D. Schedule of demolition activities indicating the following:
    1. Detailed sequence of demolition, salvage, and removal work, with starting and ending dates for each activity.
    2. Dates for shutoff, capping, and continuation of utility services.
E. Salvage Plan - Inventory of items to be removed and salvaged. Salvage plan shall show how all materials are to be sorted, salvaged and recycled. Plan must include all final destinations for each type of material.
    1. Contractor shall submit salvage plan showing how all materials are to be sorted, salvaged and recycled. Plan must include all final destinations for each type of material.
    2. Salvaged items must be transported from site as they are removed, unless materials are to be reused on site.
    3. Storage or sale of removed items on site will not be permitted, unless materials are to be reused on site.
    4. Contractor shall provide certification for all salvaged materials. Certifications may take the form of receipts from recycling facilities, manufacturers, or any other legitimate form of certification. Certification types shall be outlined in salvage plan and approved by Owner.
F. Inventory of items to be removed and salvaged, and deliver to Owner's designated storage area.
G. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and improvements that might be misconstrued as damage caused by demolition operations.
H. Pre-Demolition Conference: Conduct conference at Project site with Owner, Architect and Construction Manager

1.07 DELIVERY, STORAGE, AND HANDLING

Comply with the requirements of Section 01 66 00 Product Storage and Handling Requirements.

1.08 PROJECT CONDITIONS

Comply with the requirements of Sections 01 50 00 Construction Facilities.

1.09 RECORD DRAWINGS

Comply with the requirements of Section 01 77 00 Project Closeout.

1.10 WARRANTY

Provide manufacturer's standard warranty in accordance with Section 01 78 36 Warranties.

PART 2 – PRODUCTS

Not applicable

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which work of this Section will be performed.
B. Confirm existing conditions and correlate with requirements indicted to determine extent of demolition required.
C. Inventory and record the conditions of items to be removed and reinstalled and items to be removed and salvaged.
D. Correct conditions detrimental to timely and proper completion of the Work.
E. Do not proceed until unsatisfactory conditions are corrected.
F. Beginning of installation means acceptance of conditions.
G. Confirm condition of the building to determine whether removing any element might result in a structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during demolition.
H. Perform surveys as the Work progresses to detect hazards resulting from demolition activities.

3.02 PREPARATION

A. Conduct demolition operations and remove debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
B. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
C. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around demolition area.
    1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways.
    2. Protect existing site improvements, appurtenances, and landscaping to remain.
D. Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of building to remain.
E. Strengthen or add new supports when required during progress of demolition.

3.03 SCHEDULING

A. Protect all existing installations from damage. Take measures to prevent damage to existing facilities and finishes during demolition and construction.
B. Arrange demolition and salvage schedule so as not to interfere with Owner's on-site operations.

3.04 ITEMS REMOVED BY CONTRACTOR AND RETAINED BY OWNER

General: Items noted on drawings shall be removed without damage and turned over to Owner. Coordinate with Owner and arrange for designated storage area.

3.05 UTILITY SERVICES

A. Utility Requirements: Refer to Division 21 through Division 26 sections for shutting-off, disconnecting, removing, and sealing or capping utility services. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.
B. Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations.
C. Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by Owner, and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to governing authorities.
D. Provide not less than 72 hours notice to Owner if shutdown of service is required during changeover.

3.06 EXPLOSIVES

The use of explosives will not be permitted.

3.07 POLLUTION CONTROLS

A. Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations.
B. Do not create hazardous or objectionable conditions, such as flooding, and pollution, when using water.
C. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
D. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level.
E. Clean adjacent buildings and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing before start of demolition.

3.08 DEMOLITION

A. Demolish concrete and/or asphalt paving, and densified granite surfaces, as required to prepare for new construction.
B. Dispose of demolished items and materials promptly. On-site storage or sale of removed items is prohibited.
C. Fill below-grade areas and voids resulting from demolition of building elements and pavements and soil materials according to requirements of Division 31.
D. Promptly repair damages to adjacent facilities caused by demolition operations.
E. Wherever cutting and removal of portions of existing work is indicated, such work shall be sawn in a manner that will produce neat and straight lines, parallel to adjacent surfaces or plumb for vertical surfaces. Execute cutting and demolition by methods which will prevent

damage to other work, and which will provide proper surfaces to receive installation of repairs and new work.

3.09 DISPOSAL OF DEMOLISHED MATERIALS

A. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
B. Removal: All materials resulting from demolition work, except those items specifically listed to be retained by Owner, shall become property of contractor and shall be removed from premises. All material to be removed needs to be out of the area as scheduled.
    1. Establish haul routes in advance and post flagmen to assure safety of public and workmen.
    2. Keep streets (and facilities) free of mud, rubbish, etc. Assume responsibility for any damage resulting from hauling operations and hold Owner free and clear of any liability in connection therewith.
C. Burning demolished materials is not allowed.
D. Transport demolished materials off Owner's property and legally dispose of these materials.

END OF SECTION

SECTION 04 22 00

CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Steel reinforcing bars.

1.02 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).
B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Shop Drawings: For reinforcing steel. Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.
C. Samples: For each type and color of the following:

1. Pigmented and colored-aggregate mortar.

1.04 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of product. For masonry units, include data on material properties and material test reports substantiating compliance with requirements.
B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
2. Include test reports, in accordance with ASTM C1019, for grout mixes required to comply with compressive strength requirement.

1.05 QUALITY ASSURANCE

A. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.

1. Build sample panels for each type of exposed unit masonry construction in sizes approximately 60 inches (1500 mm) long by 48 inches (1200 mm) high by full thickness.

1.06 FIELD CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.01 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

1. Where fire-resistance-rated construction is indicated, units are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.02 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

B. CMUs: ASTM C90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength as indicated on the drawings.
2. Density Classification: Medium weight unless otherwise indicated.

2.03 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Masonry Cement: ASTM C91/C91M.

E. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.

F. Colored Cement Products: Packaged blend made from portland cement and hydrated lime mortar pigments, all complying with specified requirements, and containing no other ingredients.

G. Aggregate for Mortar: ASTM C144.

1. White-Mortar Aggregates: Natural white sand or crushed white stone.
2. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

H. Aggregate for Grout: ASTM C404.

I. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

J. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.

K. Water: Potable.

2.04 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60 (Grade 420).

2.05 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270. Provide the following types of mortar for applications stated unless another type is indicated.

1. For reinforced masonry, use Type S.

D. Pigmented Mortar: Use colored cement product

1. Application: Use pigmented mortar for exposed mortar joints with the following units:

a. Decorative CMUs.
b. Pre-faced CMUs.

E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

1. Application: Use colored-aggregate mortar for exposed mortar joints with the following units:

a. Decorative CMUs.
b. Pre-faced CMUs.

F. Grout for Unit Masonry: Comply with ASTM C476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C476, paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi (14 MPa).
3. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured in accordance with ASTM C143/C143M.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.02 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).

2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
2. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm).

3.03 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
D. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
E. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
F. Fill cores in hollow CMUs with grout as indicated.

3.04 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.

B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.05 FLASHING

A. General: Install embedded flashing at ledges and other obstructions to downward flow of water in wall where indicated.
B. Install flashing as follows unless otherwise indicated:

1. At lintels, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
2. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.

C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

3.06 REINFORCED UNIT MASONRY

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.
C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches (1520 mm) unless otherwise noted

3.07 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements is done at Contractor's expense.
B. Inspections: Special inspections in accordance with Level C in TMS 402/ACI 530/ASCE 5.

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.

2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Frequency: One set of tests for each 5000 sq. ft. (464 sq. m) of wall area or portion thereof.
D. Concrete Masonry Unit Test: For each type of unit provided, in accordance with ASTM C140 for compressive strength.
E. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, in accordance with ASTM C780.
F. Mortar Test (Property Specification): For each mix provided, in accordance with ASTM C780. Test mortar for compressive strength.
G. Grout Test (Compressive Strength): For each mix provided, in accordance with ASTM C1019.
H. Prism Test: For each type of construction provided, in accordance with ASTM C1314 at 28 days.

3.08 PARGING

A. Parge exterior faces of below-grade masonry walls, where indicated, in two uniform coats to a total thickness of 3/4 inch (19 mm). Dampen wall before applying first coat, and scarify first coat to ensure full bond to subsequent coat.
B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot (3 mm per 300 mm). Form a wash at top of parging and a cove at bottom.
C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.09 REPAIRING, POINTING, AND CLEANING

A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
2. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.010 MASONRY WASTE DISPOSAL

A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.

B. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

SECTION 06 41 00

ARCHITECTURAL CASEWORK

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract requirements and Division 1, General Conditions apply to this section.

1.02 SCOPE OF WORK SUMMARY

A. Section Includes:

1. Plastic laminate casework
2. Plastic laminate countertops
3. Solid surface countertops
4. Hardware typically furnished by the casework manufacturer
5. Shelving
6. Structural supports incorporated into wood casework

B. Excluding:

1. Metal support brackets and fittings that are part of the building structure
2. Plumbing, electrical fixtures, and telephone equipment

C. Related sections:

1. Rough carpentry: Wood blocking or grounds inside finished walls or above finished ceilings
2. Plumbing: Fixtures and fittings installed in countertops

1.03 STANDARDS AND REFERENCES

A. The *North American Architectural Woodwork Standards (NAAWS),* latest edition. Jointly published by Woodwork Institute and the Architectural Woodwork Manufacturers Association of Canada.
B. NEMA LD-3, High Pressure Decorative Laminate, latest edition
C. ANSI 208.1, Particle Board, latest edition
D. ANSI 208.2, MDF, latest edition

1.04 QUALITY ASSURANCE

A. Work shall be in accordance with the Grade or Grades specified of the *North American Architectural Woodwork Standards*.
B. Certified Compliance Program (CCP):

1. Before delivery to the job site, provide a Woodwork Institute Certified Compliance Certificate indicating the millwork and countertop products being supplied and certifying that these products fully meet the requirements of the *NAAWS* Grade or Grades specified.
2. Provide a Woodwork Institute Certified Compliance Label on each countertop and elevation of casework.

3. At completion of installation provide a Woodwork Institute Certified Compliance Certificate indicating the products installed, and certifying that the installation of these products fully meets the requirements of the *NAAWS* Grade or Grades specified.
4. All fees charged by the Woodwork Institute for its Certified Compliance program are the responsibility of the millwork manufacturer and/or installer and shall be included in their bid.

C. Qualification:

1. A Woodwork Institute Accredited Millwork Company in good standing.
2. Firm (woodwork and countertop manufacturer) with no less than five years of production experience similar to a specific project, whose qualifications indicate the ability to comply with the requirements of this section.
3. The woodwork manufacturer must have at least one project in the past five years where the value of the woodwork was within 20 percent of the cost of woodwork for this project.

D. Single source responsibility: A single manufacturer shall provide and install the work of described in this section.

1.05 SUBSTITUTIONS

Substitutions will be considered per Section 01 25 00 Substitution Procedures.

1.06 SUBMITTALS

A. Provide in accordance with Section 01 33 00 Submittal Procedures.
B. Shop drawings:

1. Submit shop drawings in conformance with the requirements of the *North American Architectural Woodwork Standards*.
2. Furnish a Woodwork Institute Certified Compliance Label on the first page of the shop drawings.
3. Submit two copies, one of which will be returned with reviewed notations. Make corrections noted (if any), and distribute required copies prior to the start of work.

C. Samples:

1. Submit four finished samples of each species and cut of wood to be used. Lumber samples to be minimum 6 inches by 18 inches, and sheet product samples to be minimum 12 inches square. Samples shall represent the range of color and grain expected to be provided.
2. Submit four unfinished samples of each product to be provided for job-site painting or finishing. Lumber samples to be minimum 6 inches by 18 inches, and sheet goods to be 12 inches square.
3. Submit a sample of each plastic laminate, and/or solid surface color and pattern to be used.

1.07 DELIVERY STORAGE AND HANDLING

A. Comply with the requirements of Section 01 66 00 Product Storage and Handling Requirements.
B. Coordinate fabrication, delivery, and installation with the general contractor and other applicable trades.
C. Deliver materials only when the project is ready for installation and the general contractor has provided a clean storage area.

1. Delivery of architectural millwork shall be made only when the area of operation is enclosed, all plaster and concrete work is dry and the area broom clean.
2. Maintain indoor temperature and humidity within the range to be expected after occupancy.

1.08 PROJECT CONDITIONS

Comply with the requirements of Section 01 50 00 Construction Facilities.

1.9 RECORD DRAWINGS

Comply with the requirements of Section 01 77 00 Project Closeout.

1.10 WARRANTY

Provide Manufacturer's Standard Warranty in accordance with Section 01 78 36 Warranties.

PART 2 – PRODUCTS

2.01 MILLWORK COMPONENTS

A. Lumber: In accordance with the *North American Architectural Woodwork Standards* Grade specified for the product being fabricated. Moisture Content: 6% to 12% for boards up to 2-inch (50.8 mm) nominal thickness, and shall not exceed 19% for thicker pieces.
B. Core:
    1. Particleboard meeting the requirements of *North American Architectural Woodwork Standards*.
        a. Water-resistant core, where required: Medium Density Fiberboard meeting the requirements of ANSI A208.2 Grade 130 MR-50.
C. Veneer core plywood: A non-telegraphing hardwood manufactured with exterior glue.
D. Plastic laminate: Meeting the requirements of the *North American Architectural Woodwork Standards* for its use.
    1. High pressure laminated plastic conforming to NEMA LP-3, 0.048-inch thickness for tops and 0.028-inch thickness for vertical surfaces.
    2. Low Pressure Melamine for exposed interior and semi-exposed surfaces.
    3. Backing sheet: LD-3-BK 20 backing grade undecorated plastic laminate.
E. Edgeband: 3mm PVC for doors and drawer fronts and 1mm for cabinet body & shelves of the same pattern and color as the exposed surfaces.
F. Hardboard: PS-58, pressed wood fiber with resin binder, tempered grade, smooth two sides for drawer bottoms.
G. Adhesives: Type II, water-resistant typical. Type I, fully waterproof at sink tops and sink cabinets.
H. Hardware:
    1. Finish: Satin aluminum unless noted otherwise.
    2. Pulls: Amerock BP76312-G10 or Architect approved equal.
    3. Drawer guides for Drawers 24" wide or less: 100-pound capacity, full extension, ball bearing. Accuride 3832 or Architect approved equal.
    4. Drawer guides for File, Paper Storage and Heavy-Duty Drawers 42" wide or less: 150-pound capacity, over travel extension, ball bearing. Accuride 4043 or Architect approved equal.

5. Hinges: Concealed, European style, self-closing, Grade II hinges minimum 120 degree opening.
6. Shelf supports: Knape & Vogt KV 255 or Architect approved equal.
7. Shelf clips: Knape & Vogt KV 256 or Architect approved equal.
8. Locks: Provide on all doors and drawers unless noted otherwise in Drawings.
    a. Door locks: Olympus Door Lock 100 series or Architect approved equal.
    b. Drawer locks: Olympus Door Lock 200 series with re-keying feature or Architect approved equal.
    c. Keying: Contractor to confirm with client keying type and quantities prior to construction.
9. Miscellaneous Accessories: Provide grommet(s) as indicated in the Drawings.

2.02 MILLWORK FABRICATION

A. Grade: *NAAWS* Custom Grade.
B. Exposed exterior surfaces: High-pressure decorative laminate Grade VGS. Color and pattern as indicated in the Drawings.
C. Exposed interior (open cases) and semi-exposed (behind doors) interior surfaces: White melamine.
D. Cabinet construction type: Frameless.
E. Door Interface Style: Flush overlay
F. Edgebanding at all exposed and semi-exposed edges including doors, drawer fronts and false fronts: 3mm PVC of the same color and pattern as the exposed surfaces.
G. Shelves: Adjustable shelves to be 1" thick.
H. Doors and drawer fronts: High pressure laminate Grade VGS face, cabinet liner Grade CLS back.
I. Drawer Boxes:
    1. Front and back: 1/2" particleboard with melamine surfacing.
    2. Sides: 1/2" Particle board with melamine surfacing
    3. Bottoms: 1/4" Hardboard
    4. Joinery: Dowels

2.03 COUNTERTOPS

A. Grade: *NAAWS* Custom Grade
B. Plastic Laminate
    1. Flat countertops: NEMA LD-3 Grade HGS. 0.048" thick.
    2. Formed countertops: NEMA LD-3 Grade HGP. 0.039" thick.
    3. Manufacturer, Pattern, Color: As indicated in the Drawings.
    4. Core: 3/4" Particleboard, composed of wood chips and waterproof resin binders at dry tops, 3/4" MDF MR-50 at sink tops.
    5. Backsplash detail: Cove, 4" high minimum
    6. Front edge: No-drip bullnose edge

7. Cutouts: Seal edges of cutouts in sink countertops with a color-toned (for verification) water-resistant sealer before sinks are installed.

C. Solid Surface
   1. Manufacturer, Pattern, Color: As indicated in the Drawings
   2. Backsplash detail: Cove, 4" high minimum.
   3. Front edge: No-drip bullnose edge

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which work of this Section will be performed.
B. Correct conditions detrimental to timely and proper completion of the Work.
C. Do not proceed until unsatisfactory conditions are corrected.
D. Beginning of installation means acceptance of conditions.
E. Verify that surfaces and openings are ready to receive work and field measurements are as shown on Shop Drawings and instructed by the fabricator. Verify dimensions for work of other trades incorporated into the casework.
F. Verify the adequacy and proper location of any required backing or support framing.
G. Verify that mechanical, electrical, plumbing, and other building components affecting work in this section are in place and ready.

3.02 INSTALLATION

A. Install all work in conformance with the *North American Architectural Woodwork Standards*, latest edition.
   1. Installation shall conform to the *NAAWS* grade of the items being installed.
B. All work shall be secured in place, square, plumb, and level.
C. All work abutting other building components shall be properly scribed.
D. Mechanical fasteners used at exposed and semi-exposed surfaces, excluding installation attachment screws and those securing cabinets end to end, shall be countersunk.
E. Equipment cutouts shown on plans shall be cut by the installer.

3.03 ADJUSTING AND TOUCH UP

A. Before completing installation, the installer shall adjust all moving and operating parts to function smoothly and correctly.
B. All nicks, chips, and scratches in the finish shall be filled and retouched. Damaged items that cannot be repaired shall be replaced.

3.04 CLEANUP

A. Upon completion of installation, the installer shall clean all installed items of pencil and ink marks and broom clean the area of operation, depositing debris in containers provided by the general contractor.

END OF SECTION

SECTION 06 60 00

PLASTIC FABRICATIONS

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SCOPE OF WORK SUMMARY

A. Provide factory-finished Surface Materials and similar items where shown on the drawings, as specified herein, and as needed for a complete and proper installation. Work may include, but is not limited to:

1. Standard Decorative Laminates.
2. Solid Surfacing.

1.03 STANDARDS AND REFERENCES

A. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics.

B. ASTM G 21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

C. ISO 4586-2 - High Pressure Decorative Laminates; International Organization for Standardization.

1.04 QUALITY ASSURANCE

Comply with the Standard requirements established by Manufacturer.

1.05 SUBSTITUTIONS

Substitutions will be considered per Section 01 25 00 Substitution Procedures.

1.06 SUBMITTALS

A. Provide in accordance with Section 01 33 00 Submittal Procedures.

B. Samples:

1. Selection Samples: Submit actual samples of surfacing materials to illustrate full range of colors, patterns, and finishes available.

2. Verification Samples: Submit two samples, each 12 inches square; illustrating each selected surfacing material in specified color, pattern, and finish.

C. Manufacturer's Instructions:

1. Submit manufacturer's printed installation instructions for each product.
2. Submit manufacturer's Safety Data Sheets (M.S.D.S.) for each adhesive.

1.07 DELIVERY, STORAGE, AND HANDLING

Comply with Section 01 66 00 Product Storage and Handling Requirements.

1.08 PROJECT CONDITIONS

A. Comply with the requirements of Section 01 50 00 Construction Facilities.

B. Comply with Manufacturer’s Standard Requirements.

1.09 OPERATION AND MAINTENANCE DATA

Comply with the requirements of Section 01 77 00 Project Closeout.

1.10 RECORD DRAWINGS

Comply with the requirements of Section 01 77 00 Project Closeout.

1.11 WARRANTY

Provide Manufacturer's Standard Warranty in accordance with Section 01 78 36 Warranties.

PART 2 – PRODUCTS

2.01 STANDARD DECORATIVE LAMINATES

A. Acceptable Products: As indicated on the Drawings.

B. Product Description: Decorative surface papers, impregnated with melamine resins, bonded under heat and pressure to kraft papers impregnated with phenolic resins.

C. Standard Decorative Laminate – General Purpose Type: having the following physical characteristics:

1. Sheet thickness: 0.048-inch (1.219 mm) plus/minus 0.005-inch (0.127 mm).
2. Exceeding performance requirements of NEMA LD 3-1995 Grade HGS.
3. Surface burning characteristics in accordance with ASTM E 84; unbonded: Flame spread 55; Smoke developed 30.
4. Patterns and Finishes: Selected from manufacturer's full range of available selections, as selected and approved by Architect.

2.02 SOLID SURFACING MATERIAL

A. Acceptable Product: As indicated on the Drawings.

B. Product Description: Homogenous sheet material composed of acrylic resins, fire-retardant filler materials, and coloring agents.

1. Nominal sheet thickness: 0.50 inch (13 mm).
2. Surface burning characteristics in accordance with ASTM E 84: Flame spread less than 25; Smoke developed less than 25.
3. Liquid Absorption, ISO 4586-2, for 1/2-inch material thickness: 0.4 percent after 2 hours boiling water.

C. Izod Impact, ASTM D 256, Method A: 0.2 foot pounds per inch.

1. Tensile Modulus, ASTM D 638 Nominal: 1.7 million pounds per square inch.
2. Thermal Expansion, ASTM D 696: 0.000019-inch per inch per degree F, maximum.
3. Hardness, ASTM D 2583, Barcol Impressor: 59.
4. Flexural Modulus, ASTM D 790: 1.6 million pounds per square inch.
5. Deflection Temperature under load, ASTM D 648: 90 degrees C.
6. Stain Resistance: ANSI Z124.6 modified, Method 3.4: No effect.
7. Boiling Water Resistance, NEMA LD 3-1995, Method 3.5: No effect.
8. High Temperature Resistance: NEMA LD 3-1995, Method 3.6: No effect.
9. Radiant Heat Resistance: NEMA LD 3-1995, Method 3.10: No effect.
10. Light Resistance: NEMA LD 3-1995, Method 3.3: No effect.
11. Ball Impact Resistance, NEMA LD 3-1995, Method 3.8, one half pound ball, unsupported: 125 inches.

12. Specific Gravity: 0.977 ounces per cubic inch (1.69 grams per cubic centimeter).
13. Approximate weight: 4.2 pounds per square foot (20.5 kg/square m).
14. Weatherability: ASTM D 2565: Pass.
15. Fungus Resistance, ASTM G 21: Pass.
16. Bacterial Resistance, ASTM G 22: Pass.
17. Pittsburgh Protocol Toxicity: 66.9 grams.
18. Patterns and Finishes: Selected from manufacturer's full range of available selections, selected and approved by Architect.
19. Impact Resistance NEMA LD3-1995 (1/2 lb. Ball) SSV bonded to substrate*** Method 3.08 modified. 125" (No Failure)
20. Tensile Toughness ASTM D 638. 21 (in. – lb./in. ^{3})
21. Tensile Modulus ASTM D 638 Nominal. 1.7 x 10^{-5} lb./in.^{3}
22. Density 1.60 gram/cm^3
23. Approximate weight 4.2 lbs./ft^2
24. Pittsburgh Protocol Toxicity = 30 grams range

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which work of this Section will be performed.
B. Verify that specified items may be installed in accordance with the approved design.
C. Correct conditions detrimental to timely and proper completion of the Work.
D. Do not proceed until unsatisfactory conditions are corrected.
E. Beginning of installation means acceptance of conditions.

3.02 PREPARATION

Surface preparation: Precondition surfacing materials and surfaces to receive surfacing materials in accordance with manufacturer's printed installation instructions.

3.03 APPLICATION

Install materials in accordance with manufacturer's printed instructions.

END OF SECTION

SECTION 07 05 00

CONCRETE FLOOR TESTING

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SCOPE OF WORK SUMMARY

A. Administrative and procedural requirements for testing interior concrete slabs for moisture vapor emission rate, alkalinity, and temperature and humidity.
B. Testing shall be conducted by the Contractor's Testing Agency.

1.03 STANDARDS AND REFERENCES

A. ASTM F-1869 Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor using Anhydrous Calcium Chloride.
B. ASTM F-710 Standard Practice for Preparing Concrete Floors and other Monolithic Floors to receive Resilient Flooring.
C. ASTM F-2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

1.04 QUALITY ASSURANCE

A. Contractor Responsibilities: Contractor will engage a qualified testing agency to perform testing indicated.

    1. Contractor will furnish Owner with name, address, and telephone number of testing agency.
    2. Payment for testing services will be made by the Contractor directly to the testing agency.

        a. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be paid by the Contractor.

B. Testing Agency Responsibilities: Cooperate with Architect, Owner or Owner's Representative, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

    1. Notify Architect, Owner or Owner's Representative, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
    2. Determine the location from which test samples will be taken.
    3. Perform tests and submit a certified written report of each test, inspection, and similar quality-control service to Owner, Architect, Construction Manager and Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
    4. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
    5. Do not perform any duties of Contractor.

C. Contractor Responsibilities: Coordinate sequence of activities to accommodate required testing services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities. Notify agency sufficiently in advance of operations to permit assignment of personnel.
2. Acclimate enclosed spaces to the anticipated occupied temperature and humidity as required by the manufacturer of the specified flooring material(s) and in accordance with ASTM testing requirements.
3. Cooperate with agencies performing required tests and inspections, provide reasonable auxiliary services as requested. Provide the following:

    a. Access to the Work.
    b. Incidental labor and facilities necessary to facilitate tests and inspections.
    c. Security and protection for testing and inspecting equipment at Project site.

4. Project Meeting: Schedule and conduct project meeting not less than 30 days prior to flooring installation to discuss testing requirements, specifications and locations prior to testing. Attendees shall include Owner or Owner's Representative, Architect, Contractor, Testing Agency, and adhered floor installer representatives.

1.05 SUBSTITUTIONS

Substitutions will be considered per Section 01 25 00 Substitution Procedures.

1.06 SUBMITTALS

A. Provide in accordance with Section 01 33 00 Submittal Procedures.
B. Reports: Reports of results of all testing shall be submitted by the Contractor's Testing Agency. Reports shall include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. For each test provide a record of interior temperature, humidity, moisture vapor emission, in-concrete relative humidity and alkalinity results for testing period.
8. Test and inspection results and an interpretation of test results.
9. Provide on the Architectural Floor Plan(s) as furnished by the Architect a test number identifying each test conducted.
10. Name and signature of laboratory inspector.
11. Recommendations on retesting and re-inspecting.

1.07 PROJECT CONDITIONS

Comply with the requirements of Section 01 50 00 Construction Facilities.

1.08 WARRANTY

Provide Manufacturer's Standard Warranty in accordance with Section 01 78 36 Warranties.

PART 2 – PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment to be provided by Testing Agency.
B. American Moisture Test, Inc., Website: americanmoisturetest.com, Tel: (866) 670-9700.

1. ASTM F1869 Moisture Vapor Emission Test kits
2. ASTM F-2170 In-Concrete Relative Humidity Testing System
3. ASTM F-710 Alkalinity-pH wide range 1 – 14pH meter

PART 3 – EXECUTION

3.01 EXAMINATION

Site: Weatherproofed, doors installed and windows secured. Do not start testing process when site has standing water, surface contaminants, exposed to exterior conditions or concrete installation is less than 90 days of age.

3.02 PREPARATION

A. Contractor Responsibilities:

1. Preparation of Substrates:

a. Prepare concrete substrates according to ASTM requirements.
b. Verify that substrates are dry and free of curing compounds, sealers, and hardeners for vapor emission testing per ASTM F-1869.
c. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

2. Temperature and Humidity: Maintain site at the temperature and humidity conditions to those anticipated during normal occupancy and maintain these conditions 48 hours prior and during testing period. If meeting this criteria is not possible, then minimum conditions should be 75± 10°F and 50± 10% relative humidity.

a. When a building is not under HVAC control, record temperature and humidity at start and end of testing using a portable data logging system.

3.03 TESTING

A. Testing: Testing Agency shall perform tests as follows:

1. Water vapor emission testing, ASTM F 1869.

a. Perform all gram scale weights on site.
b. Expose dome for 60 to 72 hours.
c. Report results as pounds of emission per 24 hours per ASTM F-1869.
d. Perform subfloor moisture testing in accordance with the Manufacturer's requirements for each floor system type. Do not proceed with flooring installation until results of moisture tests are acceptable. All test results shall be documented and retained

2. In-Concrete Relative humidity testing, ASTM F 2170.

a. Satisfactory results shall have a maximum 75 percent relative humidity level measurement.

3. Alkalinity Testing:

    a. Apply neutral-pH solution to form a 1-inch diameter circle directly to interior of moisture dome.
    b. Allow to absorb into concrete for 1 minute.
    c. Apply flat tip pH meter to solution and document result as required by manufacturer.
    d. Perform pH tests on concrete floors regardless of their age or grade level in accordance with the Manufacturer's requirements for each floor system type. PH level shall not exceed range of the Manufacturer's requirements for each floor system type. All test results shall be documented and retained

B. Adhered floor coverings shall not be installed in areas where satisfactory test results have not been obtained.
C. Consult Architect on remedial measures to reduce concrete levels prior to installing flooring. Installation of flooring deems acceptance of on-site conditions for a warranted application.

3.04 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
B. Comply with the Contract Document requirements for Division 01 Section "Cutting and Patching."
C. Protect construction exposed by or for quality-control service activities.
D. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 07 26 16

BELOW-GRADE VAPOR BARRIER

PART 1 – GENERAL

1.01 GENERAL REQUIRMENTS

Division 0, Contract requirements and Division 1, General Conditions apply to this section.

1.02 SCOPE OF WORK SUMMARY

A. Supply and install all below-grade vapor barriers, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete and proper installation.
B. Section includes, but is not limited to:
    1. Section 02 06 14 and/or Soils Report for subgrade preparation.
    2. Section 03 30 00 Cast-in-Place Concrete.

1.03 STANDARDS AND REFERENCES

A. ASTM D1709 – 16ae Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
B. ASTM E96-22 - Standard Test Methods for Water Vapor Transmission of Materials.
C. ASTM E154-08 - Standard Test Methods for Water Vapor Barriers Used in Contact with Earth Under Concrete Slabs.
D. ASTM E1643-18a - Standard Practice for Installation of Water Vapor Barriers Used in Contact with Earth or Granular Fill Under Concrete Slabs.
E. ASTM E1745-17 - Standard Specification for Plastic Water Vapor Barriers Used in Contact with Soil or Granular Fill Under Concrete Slabs.
F. ASTM F1249-20 Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.
G. ACI 302.2R-06: Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.
H. ACI 302.1R-15: Guide to Concrete Floor and Slab Construction.

1.04 QUALITY ASSURANCE

A. Use an experienced installer and adequate number of skilled personnel who are thoroughly trained and experienced in the application of the vapor barrier.
B. Obtain vapor barrier materials from a single manufacturer regularly engaged in manufacturing the product.
C. Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOCs).
D. Pre-Construction Meeting: Convene one week prior to installation of under slab vapor barrier. Attendees to be as follows: - Architect, Engineer, General Contractor, Vapor Barrier Installer, and Vapor Barrier Manufacturer to discuss the application in detail.
E. Contact Vapor Barrier Manufacturer prior to the start of the installation to schedule a review, in person or digital, of the vapor barrier installation.

1.05 SUBSTITUTIONS

Substitutions will be considered per Section 01 25 00 Substitution Procedures.

1.06 SUBMITTALS

A. Provide in accordance with Section 01 33 00 Submittal Procedures.

B. Summary of test results per paragraph 9.3 of ASTM E1745.
C. Manufacturer's samples and literature.
D. Manufacturer's installation instructions for placement, seaming, penetration prevention and repair, and perimeter seal per ASTM E1643.
E. Provide third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1

1.07 DELIVERY, STORAGE AND HANDLING

A. Comply with the requirements of Section 01 66 00 Product Storage and Handling Requirements.
B. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
C. Store materials in a clean, dry area in accordance with manufacturer's instructions.
D. Protect materials during handling and application to prevent damage or contamination
E. Ensure membrane is stamped with manufacturer's name, product name, and membrane thickness at intervals of no more than 85" (220 cm).

1.08 PROJECT CONDITIONS

Comply with the requirements of Section 01 50 00 Construction Facilities.

1.09 WARRANTY

A. Vapor barrier manufacturer must warrant in writing (a) compliance with the designated ASTM E1745 classification, and (b) no manufacturing defects in the product for, at least, the Life of the Building.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Stego Wrap 15 Mil Vapor Barrier by Stego Industries
B. Or Architect approved equal meeting all specified criteria

2.02 MATERIALS

A. Vapor Barrier must have the following qualities:
    1. Permeance: Maintain permeance of less than 0.01 Perms [grains/(ft2 · hr · inHg)] as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).
    2. Puncture and Tensile Strength: Comply with ASTM E1745 Class A
    3. All mandatory ASTM E1745 testing must be performed on a single production roll per ASTM E1745 Section 8.1.
    4. Thickness: 15 mils minimum
B. Vapor Barrier Accessories:
    1. Seams:
        a. Stego Tape by Stego Industries
    2. Sealing Utility Penetrations of Vapor Barrier:
        a. Stego Tape by Stego Industries
        b. Stego Mastic by Stego Industries
    3. Perimeter/Terminated Edge Seal:
        a. Stego Crete Claw (Textured Tape) by Stego Industries

b. StegoTack Tape (Double-Sided Sealant Tape) by Stego Industries
c. Stego Mastic by Stego Industries
d. One-sided seaming tape is not a recommended method of sealing at the terminated edge.

4. Penetration Prevention
   a. Beast Foot by Stego Industries

C. Pipe Boots: Construct from vapor barrier sheeting material and pressure sensitive tape in accordance with manufacturer's instructions.

PART 3 – EXECUTION

3.01 INSPECTION

A. Below grade and grading work and items penetrating moisture barrier shall be completed prior to start of installation.
B. Examine the areas and conditions under which work of this Section will be performed.
C. Correct conditions detrimental to timely and proper completion of the Work.
D. Do not proceed until unsatisfactory conditions are corrected.
E. Beginning of installation means acceptance of conditions.

3.02 INSTALLATION REQUIREMENTS

A. Install Vapor Barrier in accordance with the requirements of ASTM E1643:
   1. Unroll with the longest dimension parallel with the direction of the pour and face laps away from the expected direction of placement whenever possible.
   2. Extend vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise (a) at a point acceptable to the structural engineer or (b) where obstructed by impediments, such as dowels, waterstops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the foundation wall, grade beam or slab itself.
      a. Seal vapor barrier to the entire slab perimeter using manufacturer's textured tape with a surface that creates a mechanical seal to freshly placed concrete, per manufacturer's instructions.

      OR

      b. Seal vapor barrier to the entire perimeter wall or footing/grade beam with manufacturer's double-sided tape, or both termination bar and double-sided tape, per manufacturer's instructions. Ensure the concrete is clean and dry prior to adhering tape.
   3. Overlap joints 6-inches and seal with manufacturer's pressure sensitive tape.
   4. Apply seam tape/textured tape/double-sided tape to a clean and dry vapor barrier.
   5. Seal penetrations, including pipes, per manufacturer's instructions.
   6. Avoid the use of stakes driven through vapor barrier by utilizing screed and forming systems that will not puncture the vapor barrier.
   7. Repair damaged areas by cutting patches of vapor barrier sheeting, overlapping damaged area 6-inches and taping all four sides with pressure sensitive tape.

END OF SECTION

SECTION 07 60 00

FLASHING AND SHEET METAL

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SCOPE OF WORK SUMMARY

Furnish materials and perform labor required to execute this work as indicated on the drawings, as specified and as necessary to comply with the Contract Documents, including, but not limited to, these major items:

A. All metal wall flashings, related flashing, coping and caps.
B. Flashing at curbed openings, and other miscellaneous areas where indicated on the drawings.
C. Flashing flanges for roof drains and overflows.
D. Flashing at parapet walls that receive roofing membrane.
E. Flashing and metal covers at mechanical equipment platforms.
F. Gutters and downspouts.
G. Rain Water Leaders, Collectors and Scuppers.
H. Shop and field priming, shop painting, galvanizing, screening, caulking, anchors and anchor straps, clips, etc.
I. Shop drawings of all sheet metal work including expansion joints.

1.03 STANDARDS AND REFERENCES

Comply with the Industry Standards and References as established by Manufacturer.

1.04 QUALITY ASSURANCE

A. Verify drawing dimensions with actual field conditions. Inspect related work and adjacent surfaces.

B. Report to the Architect all conditions that prevent proper execution of this work.

1.05 SUBSTITUTIONS

Substitutions will be considered per Section 01 25 00 Substitution Procedures.

1.06 SUBMITTALS

A. Provide in accordance with Section 01 33 00 Submittal Procedures.
B. Shop Drawings: submit: all information required for fabrication, finishing and installation of this work in complete details.

1.07 DELIVERY, STORAGE, AND HANDLING

Comply with Section 01 66 00 Product Storage and Handling Requirements.

1.08 PROJECT CONDITIONS

A. Comply with the requirements of Section 01 50 00 Construction Facilities.
B. Comply with Manufacturer's Standard Requirements.

1.09 OPERATION AND MAINTENANCE DATA
Provide in accordance with Section 01 77 00 Project Closeout.

1.10 RECORD DRAWINGS
Provide in accordance with Section 01 77 00 Project Closeout.

1.11 WARRANTY
A. Provide Warranty in accordance with Section 01 78 36 Warranties.
B. Contractor guarantees the work covered by this specification against all defects in material and workmanship for a period of not less than five (5) years from the date the Owner records Notice of Completion.

PART 2 – PRODUCTS

2.01 MATERIALS
A. Galvanized Sheet Metal: Conform to ASTM A525, thickness indicated or specified, but not less than 24-gauge. Zinc coating shall weigh not less than 1-1/2 ounces, or more than 1-1/2 ounces per square foot of surface covered.
B. Solder: Standard Grade-A brand of 50:50 Alloy Lead-Tin, complying with ASTM B32. Name of manufacturer and grade designation shall be cast or die-marked on each bar.
C. Solder Flux: Raw muratic acid for galvanized metal and zinc; resin for tin, lead, and tinned copper; and non-corrosive soldering salts for uncoated copper.
D. Sheet Metal Fasteners: Rivets, nails, sheet metal screws, self-tapping screws, and stove bolts, of the type and size best adapted to the condition of use. Provide fasteners of the type specified or indicated.
    1. Use: galvanized steel, cadmium-plated steel or 300 Series alloy stainless steel.
    2. Pop rivets may be used for metal-to-metal connections when future disassembly is not required. Open-end type may be used for all applications except where watertight connections are required, in which case, use closed end type.
E. Caulking Compound: Provide as specified under Section 07 90 00. Apply as recommended by the manufacturer, caulking compound of proper consistencies for gun and knife application as necessary.
F. Shop Prime Coat: Rust-Oleum Corporation. Apply #3202 to 1/2 mil wet coating thickness, #3268 to 1-mil dry coating thickness or provide primer as specified under Section 09 90 00.
G. Shop Color Coat: Pre-coat in shop with coating of color to match adjoining surfaces.

PART 3 – EXECUTION

3.01 EXAMINATION
A. Examine the areas and conditions under which work of this Section will be performed.
B. Correct conditions detrimental to timely and proper completion of the Work.
C. Do not proceed until unsatisfactory conditions are corrected.
D. Beginning of installation means acceptance of conditions.

3.02 FABRICATION AND ASSEMBLY

A. Workmanship: Fabricate and finish metal work in a first class manner in accordance with best trade practices with all joints and corners accurately machined, filed and fitted, and rigidly framed together and connected. Carefully match components to produce perfect continuity of line and design. Make joints and connections in exterior face metal watertight, using approved scaling materials and methods of assembly. Fit faces of metal in contact with hairline joints, except as otherwise indicated or required for expansion or fitting. Conceal fastenings, unless otherwise indicated. Conceal required reinforcements within the finished assembly.

B. Expansion and Contraction: Form and fabricate work to adequately provide for thermal expansion and contraction and building movement in the completed work, without over-stressing the materials, breaking connections, or producing wrinkles and distortion in finished surfaces. Finish sheet metal work water and weathertight throughout.

C. Attachment Clips: Where subject to thermal expansion and contraction, attach members with clips to permit movement without damage to the installation, or provide slotted or over-size holes with washers where appearance is not critical, as approved by the Architect.

D. Lock Seams: Make lock seam work flat and true to line; sweat full of solder except where installed to permit expansion and contraction. Lap flat lock seams, and lap seams where soldered, according to pitch but in no case less than 4". Make seams in direction of flow. Fill expansion joints with sealant. Plane surfaces shall be free of buckles. Provide reinforcement as necessary. Cleat and fasten substantially on approximately eight-inch centers. All cap flashing and gutter seams to be flat lock seams.

E. Soldering: Thoroughly clean and tin material prior to soldering. Solder with heavy coppers of blunt design, properly tinned before use. For flat seam work they shall not weight less than ten pounds per pair, and for other work not less than size pounds per pair. Solder slowly with well-heated coppers, heating the seams thoroughly and completely filling them with solder. Finish surfaces neatly, full flowing and smooth. Wash acid flux thoroughly with a soda solution after soldering and completely remove soldering flux on exposed surfaces.

F. Welding: Conform to the requirements of AWS "Standard Code for Arc and Gas Welding". Perform welding in a manner resulting in strong, durable, tight, flush, smooth, and clean joints. Weld sheet steel to produce full and complete fusion welds without inducing locked-in stresses in the metal or surface distortions. Welding on exposed surfaces shall be ground smooth and flush and finished to match adjacent surfaces.

G. Caulking: Where indicated, caulk joints in sheet metal work and between sheet metal work and adjacent construction with polysulfide sealing compound. Apply in accordance with Caulking and Sealants Section.

H. Coping: Shall be attached to top of parapets in strict conformance with the latest written specifications of the Sheet Metal Industry Fund of Los Angeles, and as indicated on the drawings.

I. All sheet metal work shall be examined carefully the Contractor, Owner and Architect and if necessary, tested. The Contractor shall make all repairs to damaged items as a result of this testing, leaving them in a condition satisfactory to the Architect.

END OF SECTION

SECTION 07 90 00

JOINT PROTECTION

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SCOPE OF WORK

Work included: Throughout the work, seal and caulk joints where shown on the Drawings and elsewhere as required to provide a positive barrier against passage of moisture and passage of air.

1.03 STANDARDS AND REFERENCES

Comply with the Industry Standards and References as established by Manufacturer.

1.04 QUALITY ASSURANCE

A. Conform to Sealant and Waterproofers Institute requirements for materials and installation.
B. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.
C. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.05 SUBSTITUTIONS

Substitutions will be considered per Section 01 25 00 Substitution Procedures.

1.06 SUBMITTALS

A. Provide in accordance with Section 01 33 00 Submittal Procedures.
B. Submit product data:
    1. For each sealant product indicated provide manufacturer's technical data, tested physical and performance properties, dimensioned drawings, and other data needed to prove compliance with the specified requirements.
    2. Manufacturer's recommended installation procedures which, when accepted by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.
C. Samples:
    1. Samples for Initial Selection: Three color charts showing manufacturer's standard range of colors available for each product exposed to view.
    2. Samples for Verification: Three strips of cured sealants 1/2 inch by 6 inch (13mm diameter by 150 mm.

1.07 DELIVERY, STORAGE AND HANDLING

A. Comply with Section 01 66 00 Product Storage and Handling Requirements.
B. Deliver products in original factory packaging bearing identification of product, manufacturer, and batch number. Provide Safety Data Sheets for each products.
C. Store products in a location from freezing, damage, construction activity, precipitation, and direct sunlight per manufacturer's recommendations.
D. Condition products to approximately 60 degrees F (16 degrees C) to 70 degrees F (21

degrees C) for use per manufacturer's recommendations.

E. Handle products with appropriate precautions and care as stated on Safety Data Sheet.

1.08 PROJECT CONDITIONS

A. Comply with the requirements of Section 01 50 00 Construction Facilities

B. Do not use products under conditions of precipitation, or in inclement or freezing weather. Verify that substrates are clean, dry and frost-free. Use appropriate measures for protection and supplementary heating to ensure proper curing conditions per manufacturer's recommendations if application during inclement weather occurs.

1.09 OPERATION AND MAINTENANCE DATA

Provide in accordance with 01 77 00 Project Closeout.

1.10 WARRANTY

A. Provide Manufacturer's Standard Warranty in accordance with Section 01 78 36 Warranties.

B. Warranties listed in this Section shall be in addition to, and not a limitation of other rights the owner may have under the contract documents.

C. The guarantee specified herein shall include warranties against leakage, hardening, cracking, crumbling, melting, running, shrinking or staining adjacent surfaces.

D. Contractor Guarantee: Contractor guarantees the work covered by this specification against all defects in material and workmanship for a period of not less than five (5) years from the date of Substantial Completion.

PART 2 – PRODUCTS

2.01 SEALANTS

A. Except as specifically otherwise accepted by the Architect, use only the types of sealants described as follows:

1. One component polyurethane sealant, moisture curing, low modulus, FS TT-S-0023OC, Type II, Class A, ASTM-C-920, Class 50, for vertical and horizontal joints in connection with all building materials. Do not use in traffic areas. Minimum ¼" joint; maximum 1-1/4" x 3/8" d.
    a. Dymonic 100 by Tremco
    b. MasterSeal NP1 by BASF Master Builders
    c. DynaTrol I-XL Hybrid by Pecora Corporation
2. One-part silicone sealant, moisture curing, low modulus, FS TT-S-0023OC, Type II, Class A, FS TT-S-001543A, Class A, for vertical and horizontal joints in connection with aluminum, glass and concrete materials which require greater movement capabilities. Do not use in traffic areas. Minimum joint ¼" x 3/16"d; maximum1" x ½"d.
    a. Spectrem 1 by Tremco
    b. Dowsil 790 by Dow
    c. 890NST Silicone by Pecora Corporation
3. One-part silicone sealant, medium modulus, neutral cure, FS S-0023OC, Type II, Class A, FS TT-S-001543A, Type II, Class A, ASTM C920, Class 50, for vertical and horizontal joints in connection with non-porous surfaces such as aluminum, glass, tile, laminated plastic and concrete. Do not use in traffic areas.

a. Spectrem 2 by Tremco
b. Dowsil 795 by Dow
c. 895NST Silicone by Pecora Corporation

4. Multi-Component polyurethane sealant, FS TT-S-00227E, Type I, Class A, ASTM C920 for horizontal joints in traffic areas. Minimum 3/8" wide, depth to be 3/8" to ½" - use primer.
   a. THC-901 by Tremco
   b. DynaTrol II-SG or Dynatred by Pecora Corporation
5. One-part translucent silicone sealant, medium modulus, neutral curing, FS TT-S-0023OC, Type II, Class A, FS TT-S-001543A, Type II, Class A, for vertical joints in connection with butt glazing.
   a. 895 NST by Pecora
   b. SCS2800 Silglaze II by Momentive
6. One-part mildew resistant silicone sealant meeting requirements of FDA Regulation 21 CFR 177.2600, for vertical and horizontal joints in connection with non-porous applications as sealing around bathroom fixtures, shower-tub enclosures, sinks and urinals.
   a. Dowsil 786 by Dow
   b. SCS1700 Sanitary by Momentive
   c. 898NST Silicone or 860 Silicone by Pecora Corporation
7. One-part siliconized acrylic latex polymer caulk, ASTM C834, for interior horizontal and vertical joints in connection with window and door buck perimeters, interior wall surfaces, etc.
   a. AC-20 + Silicone by Pecora
   b. Acrylic Latex by Tremco
8. Security Sealants
   a. One part, non-sag, tamper resistant security sealant, FS TT-S-00230C, Type II, Class B, ASTM C920 for doors and windows.
      i. DynaFlex SC by Pecora
      ii. MasterSeal CR 195 by BASF Master Builders.
   b. Multi-component, rigid, high-solids, high modulus epoxy resin security sealant, ASTM C881, Type I and III, Grade 3, Classes B & C.
      i. DynaPoxy EP-1200 by Pecora
      ii. Sikadur -31 BY Sika USA
9. Roof Penetrations: Use asphalt mastic conforming to ASTM D491.
10. For other services, provide products especially formulated for the proposed use and accepted in advance by the Architect.

B. Colors:

1. The Architect will select Colors for each sealant installation to match adjacent finishes from a standard color list normally available from the specified manufacturers.
2. Should a matching standard color not be available from the accepted manufacturer except at additional charge, the Contractor shall provide such colors at no additional

cost to the Owner.

3. In concealed installations, and in partially or fully exposed installations where so accepted by the Architect, use standard gray or black sealant.

2.02 PRIMERS

Use only those primers that are: non-staining, have been tested for durability on the surfaces to be sealed, and are specifically recommended for this installation by the manufacturer of the sealant used.

2.03 BACKUP MATERIALS

A. Use only those backup materials that are specifically recommended for this installation by the manufacturer of the sealant used, which are non-absorbent, and which are non-staining.

B. Acceptable types include:
   1. Closed-cell resilient urethane or polyvinyl chloride foam;
   2. Closed-cell polyethylene foam;
   3. Closed-cell sponge of vinyl or rubber;
   4. Polychloroprene tubes or beads;
   5. Polyisobutylene extrusions;
   6. Oil-less dry jute.

C. Preformed support strips for ceramic tile control joint and expansion joint work: Use polyisobutylene or polychloroprene rubber.

2.04 BOND-PREVENTATIVE MATERIALS

Use only one of the following as best suited for the application, and as recommended by the manufacturer of the sealant used:

1. Polyethylene tape, pressure-sensitive adhesive, with the adhesive required only to hold tape to the construction materials as indicated;
2. Aluminum foil complying with MIL-A-148E;
3. Wax paper complying with Fed. Spec. UU-P-270.

2.05 JOINT PACKING

Shall be installed in all joints to receive sealant. Material shall be a resilient type such as closed cell PVC foam or as recommended by the manufacturer. Oakum or other types of absorptive materials shall not be used as packing material.

2.06 OTHER MATERIALS

A. For masking around joints, provide masking tape complying with Fed. Spec. UU-T-106c.

B. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the acceptance of the Architect.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which work of this Section will be performed.
B. Verify that specified items may be installed in accordance with the approved design.
C. Correct conditions detrimental to timely and proper completion of the Work.

D. Do not proceed until unsatisfactory conditions are corrected.
E. Beginning of installation means acceptance of conditions.

3.02 PREPARATION

A. Concrete and ceramic tile surfaces:

1. Install only on surfaces that are dry, sound, and well brushed, wiping free from dust.
2. At open joints, remove dust by mechanically blown compressed air if so required.
3. Use solvent to remove oil and grease, wiping the surfaces with clean rags.
4. Where surfaces have been treated, remove the surface treatment by sandblasting or wire brushing.
5. Remove laitance and mortar from joint cavities.
6. Where backstop is required, insert the approved backup material into the joint cavity to the depth needed.

B. Steel surfaces:

1. Steel surfaces in contact with sealant:

a. Sandblast as required to achieve acceptable surface for bonding.
b. If sandblasting is not practical, or would damage adjacent finish, scrape the metal or wire brush to remove mill scale.
c. Use solvent to remove oil and grease, wiping the surfaces with clean rags.

2. Remove protective coatings on steel by sandblasting or by using a solvent that leaves no residue.

C. Aluminum surfaces:

1. Remove temporary protective coatings, dirt, oil, and grease.
2. When masking tape is used for protective cover, remove the tape just prior to applying the sealant.
3. Use only such solvents to remove protective coatings as are recommended for that purpose by the manufacturer of the aluminum work, and which are non-staining.

3.03 INSTALLATION OF BACKUP MATERIAL

A. Use only the backup material recommended by the manufacturer of the sealant used, and accepted by the Architect for the particular installation, compressing the backup material 25% to 50% to achieve a positive and secure fit.

B. When using backup of tub or rod stock, avoid lengthwise stretching of the material. Do not twist or braid hose or rod backup stock.

C. Interior and exterior joints where no backing has been provided or which is in excess of 3/4" deep shall be packed by this subcontractor with fiberglass or a suitable joint filler to reduce the depth to 1/2" maximum. Maximum movement: the width of the joint shall be at least four times its maximum movement.

3.04 PRIMING

A. Use only the primer recommended by the manufacturer of the sealant, and accepted by the Architect for the particular installation, applying in strict accordance with the manufacturer's recommendations as accepted by the Architect.

B. The priming of joints shall be by brush to reach all surfaces to which compound will be applied. Primer shall be provided on masonry, concrete and wood surfaces as

recommended by sealant manufacturer. Primer shall not be applied to surfaces that will be exposed after caulking is completed.

3.05 BOND-BREAKER INSTALLATION

Provide an approved bond-breaker where recommended by the manufacturer of the sealant, and where directed by the Architect, adhering strictly to the installation recommendations as accepted by the Architect.

3.06 INSTALLATION OF SEALANTS

A. Prior to start of installation in each joint, verify the joint type according to details on the Drawings, or as otherwise directed by the Architect, and verify that the required proportion of width of joint to depth of joint has been secured.
B. Equipment:
    1. Apply sealant under pressure with power-actuated or hand gun, or by other appropriate means.
    2. Use guns with nozzle of proper size, and providing sufficient pressure to completely fill the joints as designed.
C. Thoroughly and complete mask joints where the appearance of sealant on adjacent surfaces would be objectionable.
D. Install the sealant in strict accordance with the manufacturer's recommendations as accepted by the Architect, thoroughly filling joints to the recommended depth.
E. Tool joints to the profile shown on the Drawings, or as otherwise required if such profiles are not shown on the Drawings.
F. Cleaning up:
    1. Remove masking tape immediately after joints have been tooled.
    2. Clean adjacent surfaces free from sealant as the installation progresses, using solvent or cleaning agent recommended by the manufacturer of the sealant used.
    3. The excess material shall be cleaned from the surfaces adjacent to the joint, following the caulking operation and the top of the compound deposit shall be left with a smooth even finish. No material is permitted on the exposed face of aluminum sections.

END OF SECTION

SECTION 08 11 00

METAL DOORS AND FRAMES

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SCOPE OF WORK

Work under this section comprises of furnishing hollow metal doors and frames, including transom frames, sidelight and window frames with provision for glazed, paneled or louvered openings, fire labeled and non-labeled, as scheduled.

1.03 REFERENCES

A. Standards:
   1. Current NFPA 80 – Fire Doors and Window
   2. ANSI/SDI-100 – Recommended Specifications for Standard Steel Doors an Frames
   3. ASTM-F 476 – Standard Test Methods for Security of Swinging Doors Assemblies
   4. HMMA 862 – Guide Specifications for Commercial Security Hollow Metal Doors and Frames
   5. SDI-105 – Recommended Erection Instructions for Steel Frames
   6. SDI-107 – Hardware on Steel Doors (reinforcement application)
   7. ANSI-A250.4 – Steel Doors and Frames Physical Endurance
   8. UL10C - Standard for Positive Pressure Fire Tests of Door Assemblies
   9. UL752 – Ballistic Standards

B. Codes:
   1. Current NFPA-101 – Life Safety Code
   2. 2013 CBC – California Building Code
   3. ANSI-A117.1 – Accessible and Usable Building and Facilities
   4. Current DOJ – ADA Standards for Accessible Design - DOJ

1.04 QUALITY ASSURANCE

A. Manufacturer shall be a member in good standing of the Steel Door Institute (SDI).
B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
C. Unless specifically otherwise accepted by the Architect, provide all products of this Section from a single manufacturer.
D. Fire Rated Door Assemblies:
   1. All labeled fire door assemblies to be of a type that have been classified and listed in accordance with the latest edition of NFPA80 and test in compliance with NFPA-252, and UL10C. A physical label is to be affixed to the fire door at an authorized facility; embossed labels are acceptable on standard 3 sided door frames.

2. For openings required to be fire rated exceeding limitations of labeled assemblies, submit manufacturer's certification that each door and frame assembly has been constructed to conform to design, materials and construction equivalent to requirements for labeled construction.
3. Project requires door assemblies and components that are compliant with positive pressure and S-label requirements. Specifications must be cross-referenced and coordinated with hardware and other door manufacturers to ensure that total opening engineering is compatible with UL10C Standard for Positive Pressure Fire Tests of Door Assemblies.
4. Certification(s) of compliance shall be made available upon request by the Authority Having Jurisdiction.

1.05 SUBSTITUTIONS

Substitutions will be considered per Section 01 25 00 Substitution Procedures.

1.06 SUBMITTALS

A. Provide in accordance with Section 01 33 00 Submittal Procedures.
B. Submit:
    1. List of items that will be provided under this Section.
    2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
    3. Manufacturer's recommended installation procedures which, when accepted by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.
    4. Provide a schedule of doors and frames using same reference numbers for details and door openings as those on the contract documents.
    5. Submit shop drawings. Shop drawings should include the following information:
        a. Material thickness and/or gauge.
        b. Door core material.
        c. Mortises and reinforcements.
        d. Anchorage types.
        e. Locations of exposed fasteners.
        f. Glazed, louvered and paneled openings.
        g. Mounting locations of standard hardware

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with the requirements of Section 01 66 00 Product Storage and Handling Requirements.
B. The supplier shall deliver all materials to the project site; direct factory shipments are not allowed unless agreed upon beforehand. Supplier shall coordinate delivery times and schedules with the contractor.
C. Deliver doors cardboard wrapped or crated to provide protection during transit and jobsite storage. Provide additional protection to prevent damage to any factory-finished doors. Mark all doors and frames with opening numbers as shown on the contract documents and shop drawings.

D. Inspect doors and frames upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to the architect. Otherwise, remove and replace damaged goods as directed.
E. Store doors and frames at the building site in a dry and secure place.
    1. Place units on minimum 4" high wood blocking.
    2. Avoid use of non-vented plastic or canvas shelters that could create a humidity chamber.
    3. If cardboard wrapper on door becomes wet, remove carton immediately.
    4. Provide 1/4" spaces between stacked doors to promote air circulation.

1.08 PROJECT CONDITIONS

A. Comply with the requirements of Section 01 50 00 Construction Facilities.
B. Comply with Manufacturer's Standard Requirements.

1.09 OPERATION AND MAINTENANCE DATA

Provide in accordance with Section 01 77 00 Project Closeout.

1.10 EXTRA MATERIALS

Not required.

1.11 RECORD DRAWINGS

Comply with the requirements of Section 01 77 00 Project Closeout.

1.12 WARRANTY

A. Provide Manufacturer's Standard Warranty in accordance with Section 01 78 36 Warranties.
B. Warranties listed in this Section shall be in addition to, and not a limitation of other rights the owner may have under the contract documents.
C. All doors and frames shall be warranted in writing by the manufacturer against defects in materials and workmanship for a period of two (2) years commencing on the date of final completion and acceptance.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with requirements, provide standard hollow metal doors and frames by one of the following or Architect approved equal:

A. Security Metals
B. Door Components
C. Ceco Corporation
D. Curries Company
E. Steelcraft Company

2.02 MATERIALS

A. All doors and frames shall be manufactured of commercial quality cold rolled steel per ASTM-A366 and A568 general requirements; galvanized to A60 or G60 or galvanealed to A40 minimum coating weight standard per ASTM-A924. Internal reinforcing may be manufactured of hot rolled pickled and oiled steel per ASTM-A569

B. Supports and anchors shall be fabricated of not less than 18-gauge sheet steel, galvanized where galvanized frames are used.
C. Where items are to be built into exterior walls, inserts, bolts and fasteners shall be hot dipped galvanized in compliance with ASTM-A153, Class C or D as applicable.
D. Rust inhibitive enamel or paint primer shall be used, baked on, and suitable as a base for specified finish paints complying with ANSI A224.1, "Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces on Steel Doors and Frames."
E. Where specified supply embossed steel doors with wood grain appearance. Wood grain shall follow the pattern of a stile and rail wood door with both vertical and horizontal grain patterns. Doors with vision lites are required to have wood grain window kits.
F. Finish: See Door & Hardware Schedule and Finish Schedules.

2.03 METAL DOORS

A. Provide 1 3/4" thick doors of materials and ANSI/SDI-100 grades and models specified below, or as indicated on drawings or schedules:
    1. Interior Doors: Level 2, Model 2 – Seamless
       Interior doors shall be minimum 16-gauge steel with both lock and hinge rail edge of door intermittently welded, filled and ground smooth the full height of door. Acceptable Manufacturers/Products:
        a. Ceco: Regent-16-SEM
        b. Curries: 707N-16
        c. Steelcraft: LF16
        d. Architect Approved Equal
    2. Exterior Doors: Level 3, Model 2 – Seamless
       Exterior doors shall be minimum 16-gauge galvanized or galvanealed steel with both lock and hinge rail edge of door intermittently welded, filled and ground smooth the full height of door. Exterior doors shall be insulated with a solid slab of expanded polystyrene or polyurethane foam permanently bonded to the inside of each face skin. The top of all doors shall be closed flush by the addition of a 16-gauge screwed-in top cap and sealed to prevent water infiltration. The bottom channel shall include weep-holes. Acceptable Manufacturers/Products:
        a. Ceco: Legion-16-SEM
        b. Curries: 707N-16
        c. Steelcraft: LF16-Polystyrene
        d. Architect Approved Equal
    3. Bullet Resistant Doors
        a. Bullet resistant hollow metal doors shall be constructed with vertical steel stiffeners and fully welded vertical edge seams for enhanced strength and aesthetic appearance. Internal door construction and concealed armor plate shall vary and is dependent on the required ballistic rating. Provide ballistic level doors as follows:
            i. Level 1: Super 38 Automatic
            ii. Level 2: .357 Magnum Revolver
            iii. Level 3: .44 Magnum Revolver

iv. Level 4: 30-06 Rifle

b. Subject with compliance to the outline requirements, provide products by the following manufacturers:
   i. Ceco: Armorshield
   ii. Curries: 847/857
   iii. Security Metals
   iv. Architect Approved Equal

B. All doors shall be reinforced for hardware as shown below where necessary to preclude the use of thru-bolts.
   1. Exit Devices: 14-gauge
   2. Door Closers: 12-gauge

C. All doors shall be beveled 1/8" in 2" and shall have top and bottom channels of not less than 16-gauge, flush or inverted, welded to the face sheets. Doors shall have a full height 14-gauge hinge rail reinforcement channel, or individual 10 gauge hinge reinforcements

D. All doors to conform to ANSI-A250.4 Level "A" criteria and shall be tested to 1,000,000 operating cycles and 23 twist tests. Certification of Level "A" doors is to be submitted with approval drawings by supplier upon request. Do no bid or supply any type or gauge of door not having been tested and passed these criteria.

2.04 METAL FRAMES

A. Provide hollow metal frames for doors, transoms, sidelights, borrowed lights, and other openings, of types and styles as shown on the drawings and schedules. Conceal fastenings unless otherwise indicated:
   1. Interior Frames: Level 2, 16-gauge.
   2. Exterior Frames: Level 2, 16-gauge, galvanized or galvanealed.

B. Acceptable Manufacturers/Products:
   1. Ceco: SU Series
   2. Curries: M Series
   3. Steelcraft: F Series

C. All frames over 36" in width shall be 14-gauge.

D. Fabricate frames with mitered corners. Weld both the inside the throat of the corners and the face of the corners, re-prime at the welded areas. All welds to be flush with neatly mitered or butted material cuts.

E. All frames shall have minimum 7-gauge hinge reinforcements, 14-gauge lock strike reinforcing, and 12-gauge closer reinforcing.

F. All frames shall have minimum 7-gauge hinge reinforcements with an additional high frequency 12-gauge hinge reinforcement welded to the top hinge, 14-gauge lock strike reinforcing, and 12-gauge closer reinforcing.

G. Provide temporary shipping bars to be removed before setting frames.

H. Except on weather stripped frames, drill stops to receive three (3) silencers on strike jambs of single frames and two (2) silencers on heads of double frames.

I. Provide minimum 0.0179" thick steel plaster guards or mortar boxes at back of hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings

2.05 DOOR LOUVERS

A. Fire-Rated Louver:
   1. Each fire-rated louver shall have the listing mark of Underwriter's Laboratories Inc. affixed to louver assembly.
   2. All louvers in fire-rated doors shall be 16-gauge cold rolled steel with stainless steel operating springs.
   3. Louvers shall be sight-proof per SDI-111C.

B. Fixed-Blade Louver:
   1. All fixed blade louvers shall be 18-gauge cold rolled steel with mitered and welded frames and countersunk mounting holes.
   2. Louvers shall be sight-proof per SDI-111C.
   3. Provide insect screen where louver occur in exterior doors.

2.06 FABRICATION

A. Fabricate steel door and frame units to be rigid, neat in appearance, and free from defects, warp, or buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site. Comply with ANSI/SDI 100 requirements.
   1. Clearances shall be no more than 1/8” at jambs and heads except between non fire rated pairs of doors which may be no more than 1/4.”
   2. Clearances shall be no more than 3/4” at the bottom of the doors.
   3. Clearances shall be no more than 1/4" at thresholds and curbs allow unless otherwise detailed.

B. Fabricate exposed faces of doors and panels, including stiles and rails of non-flush units, from only cold-rolled steel sheet.
   1. All doors shall be of types and sizes on the drawings, and shall be fully welded seamless construction with no visible seams or joints on their faces or vertical edges. Doors shall be strong, rigid and neat in appearance, free from warpage or buckle. Corner bends shall be true and straight and of minimum radius for the gauge of metal used.
   2. Door faces shall be joined at their vertical edges by a continuous weld extending the full height of the door. All such welds shall be ground, filled and dressed smooth to make them invisible and provide a smooth flush surface.
   3. Top and bottom edges shall be closed with a continuous recessed 16 gauge steel channel extending the full width and spot welded to both faces. Exterior doors shall have an additional flush closing channel at the top edge. Opening shall be provided in the bottom closer for escape of entrapped moisture.
   4. Doors shall be mortised, reinforced, drilled and tapped at the factory for fully template hardware only. Where surface mounted hardware is to be applied, doors shall have reinforcing plates only, with drilling and tapping to be done in the field.
   5. The Face sheets of Exterior and Security doors shall be stiffened by continuous vertical formed steel sections occupying the full thickness of the interior space between door faces. These stiffeners shall be not less than 20 gauge, spaced not more than 6" apart and securely attached to both face sheets by spot welds not more than 4" on center. Spaces between stiffeners shall be sound deadened and insulated the full height of the door with an inorganic non-combustible batt-type material.

C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
    1. All door and louver frames shall be strong and rigid, neat in appearance, square, true and free of defects, warp and buckle. Molded members shall be clean cut, straight and of uniform profile and back-bends shall be as detailed.
    2. Corner joints shall have all contact edges closed tight, with trim faces and stops mitered and continuously welded. All welds shall be ground, filled and dressed smooth to make them invisible and provide a smooth flush surface.
    3. Unit frames for installation in stud partitions shall be provided with steel anchors of suitable design for welding to steel studs. Anchors shall be not less than 16-gauge and shall be securely welded inside each jamb. Anchors are to be spaced at 24" on center.
    4. Dust cover boxes of not less than 26-gauge shall be provided at all hardware mortises on frames to be set in masonry or drywall partitions.
D. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.
E. Unless otherwise indicated, provide exposed fasteners with countersunk flat or oval heads for exposed screws and bolts.
F. Labeled doors and frames shall be provided for those openings requiring fire protection ratings, as scheduled on the drawings. Such doors and frames shall be constructed as tested by the Underwriter's Laboratories, Inc., and shall bear their label for the required rating. Provide additional frame accessories as required to maintain the fire protection ratings once the frames are installed in the openings.
G. At exterior locations and elsewhere as shown or scheduled, assemblies fabricated as thermal-insulating door and frame assemblies and tested according to ASTM C 236 or ASTM C 976 on fully operable door assemblies. Unless otherwise indicated, provide thermal-rated assemblies with a minimum U-value rating of 0.41 Btu/sq. ft. x h x deg F.
H. Where shown or scheduled, provide door and frame assemblies fabricated as sound-reducing type, tested according to ASTM E 1408, and classified according to ASTM E 413. Unless otherwise indicated, provide acoustical assemblies with STC sound ratings of 33 or better.
I. Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements of SDI-107 and ANSI-A115 Series specifications for door and frame preparation for hardware.
J. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site. Provide internal reinforcements for all doors to receive door closers and exit devices.
K. Locate hardware as indicated on Shop Drawings or, if not indicated, according to the Door and Hardware Institute's (DHI) "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
L. Provide glazing stops with minimum 0.0359-inch- thick steel or 0.040-inch- thick aluminum.
M. Provide non-removable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
N. Provide screw-applied, removable, glazing beads on inside of glass and other panels in doors.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which work of this Section will be performed.
B. Verify that specified items may be installed in accordance with the approved design.
C. Correct conditions detrimental to timely and proper completion of the Work.
D. Do not proceed until unsatisfactory conditions are corrected.
E. Beginning of installation means acceptance of conditions.

3.02 FIELD MEASUREMENTS

Verify all opening dimensions in the field prior to fabrication and assembly of frames.

3.03 INSTALLATION

A. Install steel doors, frames, and accessories according to shop drawings, manufacturer's data, and as specified.
B. Comply with provisions of SDI-105, “Recommended Erection Instructions for Steel Door Frames,” unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
    1. Except for frames located in existing concrete, masonry, or gypsum board assembly construction, place frames before constructing enclosing walls and ceilings.
    2. In masonry construction, install at least 3 wall anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.
    3. At existing concrete or masonry construction, install at least 3 completed opening anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Set frames and secure to adjacent construction with bolts and masonry anchorage devices.
    4. In metal-stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. In steel-stud partitions, attach wall anchors to studs with screws.
    5. Install fire-rated frames according to NFPA 80.
C. Fit hollow-metal doors accurately in frames, within clearances specified in ANSI/SDI 100. Install fire rated doors with clearances specified in NFPA 80.

3.04 ADJUST AND CLEAN

A. Immediately after erection, sand smooth all rusted and damaged areas of prime coat, and apply touch-up of compatible air-drying primer.
B. Immediately before final inspection, remove protective wrappings from doors and frames.
C. Final adjustments:
    1. Check and readjust operating finish hardware items in hollow metal work just prior to final inspection.
    2. Leave work in complete and proper operating condition.
    3. Remove defective work and replace with work complying with the specified requirements.

END OF SECTION

SECTION 08 14 23.16

PLASTIC-LAMINATE-FACED WOOD DOORS

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SCOPE OF WORK SUMMARY

A. Section Includes:

1. Interior flush wood doors.

B. Related Requirements:

1. Section 08 71 00: Door hardware.

1.03 STANDARDS AND REFERENCES

Comply with the Industry Standards and References as established by Manufacturer.

1.04 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Pre-installation Meeting
   1. Conduct pre-installation meeting at Project Site.
   2. Discuss Topics:
      a. Delivery, storage and handling
      b. Coordination and Hardware and access control installers.
      c. Protection of installed doors.

1.05 SUBSTITUTIONS

Substitutions will be considered per Section 01 25 00 Substitution Procedures.

1.06 SUBMITTALS

A. Provide in accordance with Section 01 33 00 Submittal Procedures.

B. Product Data: Each type of door and finish.

1. Core and edge construction.
2. Fire rated doors.
3. Finishes.

C. Shop Drawings and Schedule:

1. Use same unit designations used in Contract Documents.
2. Hardware and wiring chase preparation.

D. Samples for Verification:

1. Each required plastic laminate; corner unit showing construction and finish minimum 8 by 10 inches.

1.07 DELIVERY, STORAGE AND HANDLING

A. Comply with the requirements of Section 01 66 00 Product Storage and Handling Requirements.
B. Package factory-finished doors individually in manufacturer's standard plastic bags, stretch wrap, or cardboard cartons.
C. Store doors inside building in clean, dry location.
D. Mark each door on top bottom rail with opening number used on Shop Drawings.

1.08 PROJECT CONDITIONS

A. Comply with the requirements of Section 01 50 00 Construction Facilities.
B. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity at occupancy levels during remainder of construction period.

1.09 OPERATION AND MAINTENANCE DATA

A. Provide in accordance with Section 01 77 00 Project Closeout.
B. Maintenance data.
C. Manufacturer warranties transferrable to Owner.

1.10 EXTRA MATERIALS

Not required.

1.11 RECORD DRAWINGS

Not required.

1.12 WARRANTIES

A. Provide manufacturer's Standard Warranty in accordance with Section 01 78 36 Warranties.
B. Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
    1. Failures include, but are not limited to, the following:
        a. Warping (bow, cup, or twist) more than 1/4 inch (6 mm) in 42-by-84-inch (1065-by-2130-mm) section.
        b. Telegraphing of core construction in face veneers exceeding 0.01 inch in 3-inch (0.25 mm in 76-mm) span.
    2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
C. Warranty Periods:
    1. Solid-Core Interior Doors and Wood Frames: Life of installation.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Products of Aspiro™ Series | Marshfield-Algoma by Masonite Architectural are specified to indicate requirements for quality and appearance.
    1. Website: masonite.com/architectural/products/aspiro-series

2. Phone: 877.332.4484

B. Approved alternates

1. Oregon Door
2. Lynden Door – LD Series Only
3. Architect approved equal.

C. Source Control: Supply all wood doors from a single manufacturer.

2.02 MANUFACTURING STANDARDS

A. Interior Flush Wood Doors: Window & Door Manufacturers Association publication ANSI/WDMA I.S. 1A "Industry Standard for Interior Architectural Wood Flush Doors".

B. Fire-Rated Wood Doors: Conforming to NFPA 80; listed and labeled for required ratings based on testing at positive pressure NFPA 252 or UL 10C by UL or other testing agency acceptable to authorities having jurisdiction

1. Temperature-Rise Limit: Where indicated, provide doors that have a maximum transmitted temperature end point of not more than 250 deg F (121 deg C) above ambient after 30 minutes of standard fire-test exposure.
2. Blocking: Provide composite blocking approved for use in doors of fire-protection ratings indicated as needed to maintain WDMA performance level and eliminate through-bolting hardware.
3. Vertical Edge Construction:

a. Category A Positive Pressure: Integral intumescent seals concealed by outer stile where required.

4. Pairs: Fire-retardant stiles with concealed intumescent seals that are listed and labeled for applications indicated without formed-steel edges and astragals.

C. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control

2.03 SOLID CORE LAMINATE-FACED (HPDL) DOORS – CHOICE LAMINATE

A. Basis of Design: Aspiro™ Series | Marshfield-Algoma™ by Masonite Architectural.

B. Solid Core Choice Laminate (HPDL) Flush Doors:

1. WDMA Quality grade: Custom
2. WDMA Performance Level: Extra Heavy Duty
3. Faces: High-pressure decorative laminates complying with NEMA LD 3, Grade HGS. Vertical and post formable grade laminates are not acceptable.

a. Colors, Patterns: As indicated in the Drawings
b. Acceptable manufacturer: Wilsonart Standard Laminate

4. Vertical Edges: Matching HPDL Edge Band applied after faces over Structural Composite Lumber. Matching 1/8 inch (3.2mm) high impact edge bonded to structural composite lumber.
5. Horizontal Edges: Structural composite lumber.
6. Core: Wood-based Particleboard (PC).
7. Construction: Five Plies; stiles and rails bonded to core, and entire unit is abrasive planed. High pressure decorative laminate with high density fiberboard (HDF) crossbands.
8. Thickness: 1-3/8 inch

C. Solid Core Choice Laminate (HPDL) Flush Doors with Glazed Lites:

1. Match appearance grade and applicable construction and performance requirements of other laminate finish flush wood doors.
2. Factory Glazing: Refer to Section 08 80 00 "Glazing" for glass view panels in flush wood doors. Factory install glass as required. Fill glazing bead nail holes in factory finished doors.
3. Glazing: Factory-installed fire-rated safety glass for door rating.
4. Metal Glazing Frames: Manufacturer's standard frame formed of 0.048-inch- (1.2-mm-) thick, cold-rolled steel sheet; with baked-enamel- or powder-coated finish.

    a. Frame Design: Metal Vision Frame 110

D. Fire-Rated Choice Laminate (HPDL) Flush Doors:

1. Match appearance grade and applicable construction and performance requirements of other laminate finish flush wood doors.
2. Ratings: Category A positive pressure

    a. 20-Minute Doors: Wood-based particleboard core
    b. 45-, 60-, 90-Minute Doors: Mineral core with blocking options.

3. Vertical Edges: High pressure decorative laminate over hardwood composite fire stile.

2.04 FABRICATION

A. Factory Fitting: Fit to frame openings with clearances specified in WDMA I.S. 1A.

1. Undercut: Maximum 3/8 inch (10 mm) above thresholds.
2. Fire-Rated Doors: Comply with NFPA 80.

B. Factory Machining: Machine doors for hardware that is not surface applied.

1. Verify dimensions for hardware mortises in metal frames before machining.

C. Contractor Option: Doors supplied with wood frames may have hardware installed at factory.
D. Door Frames:

1. Supply frames with temporary spreader bars at base.

2.05 FINISHES

A. Finish Grade: Match grade of door.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that door frames are plumb, square, and accurate size.
B. Inspect each door before installation for damage and defects per WDMA Section F-6.

3.02 INSTALLATION

A. Hardware installation is conforming to Section 08 7100 – Door Hardware.
B. Reference Standards:

1. Wood Doors: WDMA I.S. 1A
2. Fire-Rated Doors: NFPA 80.

3. Smoke-and Draft-Control Doors: NFPA 105.

C. Align doors with uniform vertical and top edge clearance.

3.03 REPAIR

A. Repair of damage or defects is subject to Architect's acceptance, including removal of soiling. Provide new replacement doors for doors that cannot be satisfactorily repaired.

3.04 PROTECTING AND CLEANING

A. Protect installed doors from damage and soiling.
B. Clean doors shortly before inspection for Substantial Completion.

END OF SECTION

SECTION 08 31 13

ACCESS DOORS AND FRAMES

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SCOPE OF WORK SUMMARY

A. Non-Rated Architectural wall and ceiling access door.
B. Related hardware and attachments.
C. Design Requirements: Verification: Obtain specific locations and sizes for required access doors and frames from trades, including mechanical and electrical, requiring access to concealed equipment and indicate on submittal schedule.

1.03 STANDARDS AND REFERENCES

Comply with the Industry Standards and References as established by Manufacturer.

1.04 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain access door and panel units, and frames for entire Project from 1 source and 1 single manufacturer.
B. Size Variations: Obtain Architect's acceptance and approval of manufacturer's standard size units that may vary slightly from sizes indicated on Drawings.
C. Coordination: Provide inserts and anchoring devices that will be built into other Work for installation of access door assemblies. Coordinate delivery with other Work to avoid delay.

1.05 SUBSTITUTIONS

Substitutions will be considered per Section 01 25 00 Substitution Procedures.

1.06 SUBMITTALS

A. Provide in accordance with Section 01 33 00 Submittal Procedures.
B. Shop Drawings:
    1. Door and panel units: Show types, elevations, thickness of metals, full size profiles of door members.
    2. Hardware: Show materials, finishes, locations of fasteners, types of fasteners, locations and types of operating hardware, and details of installation.
    3. General: Show connections of units and hardware to other Work. Include schedules showing location of each type and size of door and panel units.
C. Product Data: Manufacturer's technical data for each type of access door and panel assembly, including setting drawings, templates, fire-resistive characteristics, finish requirements, and details of anchorage devices. Include complete schedule, types, locations, construction details, finishes, latching or locking provisions, and other pertinent data.
D. Manufacturer's Installation Instructions: Indicate installation requirements and rough-in dimensions.

1.07 DELIVERY, STORAGE AND HANDLING

A. Comply with Section 01 66 00 Product Storage and Handling Requirements.
B. Package and ship per manufacturer's recommendations.
C. Store per manufacturer's instructions.

D. Store in dry area out of direct sunlight.

1.08 PROJECT CONDITIONS

Comply with the requirements of Section 01 50 00 Construction Facilities.

1.09 OPERATION AND MAINTENANCE DATA

Provide in accordance with Section 01 77 00 Project Closeout.

1.10 WARRANTY

Provide Manufacturer's Standard Warranty in accordance with Section 01 78 36 Warranties.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Nystrom Building Products: 9300 73rd Avenue North Brooklyn Park, MN 55428. Telephone: 800-547-2635. E-Mail: info@nystrom.com. Website: www.nystrom.com

B. Specifications and Drawings are based on manufacturer's literature from Nystrom Building Products. Other manufacturers shall comply with minimum levels of material, color selection, and detailing indicated in Specifications or on Drawings.

2.02 MATERIALS

A. Commercial quality, cold steel sheet with white baked on powder coat finish.

B. Galvanized, bonderized steel with white baked on powder coat finish.

2.03 ACCESS PANELS

A. Flush Access Doors (Model: NW) with Concealed Flanges for drywall (Non-Rated, General Purpose Access Door)

1. Door: Fabricate from 16-gauge cold rolled sheet steel, with multiple mounting configurations.
2. Door Size: 14"x14" and 24"x24" (see Plans for locations)
3. Frame: Fabricate from 16-gauge cold rolled sheet steel. Provide 1/4 inch mounting holes and easy install tabs.
    a. Wallboard surfaces – Integrated 16-gauge drywall bead and frame.
4. Hinge:
    a. Concealed spring button type, to allow for door removal.
5. Latching/Locking Devices: Cam latch, hex-head wrench operated
6. Finish:
    a. Type: No. 304 stainless steel with No. 4 satin polish finish.

B. Fire-Rated, Flush Access Doors (Model: IW) with Concealed Flanges.

1. Door: Face flush with frame with a core of mineral-fiber insulation enclosed in sheet metal, concealed flange for gypsum board installation, self-closing door. Fabricate from 20-gauge sheet metal, with multiple mounting configurations.
2. Door Size: 14"x14" and 24"x24" (see Plans for locations)
3. Frame: Fabricate from 16-gauge cold rolled sheet steel. Provide 1/4 inch mounting holes and easy install tabs.
    a. Wallboard surfaces – Integrated 16-gauge drywall bead and frame.
4. Hinge:

a. Concealed hinge.

5. Latching/Locking Devices: Self-closing, self-latching door hardware operated by key.
6. Finish:
   a. Type: No. 304 stainless steel with No. 4 satin polish finish.
7. Fire-Resistance Rating: 1-1/2 hours for walls, 3 hours for ceilings.
8. Temperature-Rise Rating: 250 deg F at the end of 30 minutes
9. Performance Requirement: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency for fire-protection and temperature-rise limit ratings indicated, accordingly to NFPA 252 or UL 10B.

2.04 FABRICATION

A. Manufacture each access panel assembly as an integral unit ready for installation.
B. Framing to include integral anti-flexing technology, with ¼ inch mounting holes, to reduce the twist of frame during installation.
C. Easy Install Tabs integral to framing for multiple installation methods.
D. Furnish number of latches required to hold door in flush, smooth plane when closed.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which work of this Section will be performed.
B. Verify that rough openings for door and frame are correctly sized and located.
C. Verify mechanical and electrical requirements for ceiling or wall access panels.
D. Correct conditions detrimental to timely and proper completion of the Work.
E. Do not proceed until unsatisfactory conditions are corrected.
F. Beginning of installation means acceptance of conditions.

3.02 PREPARATION

Advise installers of work relating to access panel installation including rough opening dimensions, locations of supports, and anchoring methods. Coordinate delivery with other work to avoid delay.

3.03 INSTALLATION

A. Install access door and frame units per manufacturer's written instructions.
B. Install frames plumb and level in opening. Secure rigidly in place.
C. Position units to provide convenient access to concealed Work requiring access.

3.04 ADJUST AND CLEAN

A. Adjust panel after installation for proper operation.
B. Remove and replace panels or frames that are warped, bowed, or damaged.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Door hardware, including electric hardware.
2. Third-party inspection report for fire-rated door assemblies.

B. Related Divisions:

1. Division 06 – door hardware installation
2. Division 07 – sealant at exterior thresholds
3. Division 08 – metal doors and frames, interior aluminum frames, wood doors, integrated security systems, specialty doors, storefront and glazed curtainwall systems.
4. Division 21 – fire and life safety systems
5. Division 28 – security access systems

D. Omissions: Hardware for the following is specified or indicated elsewhere.

1. Windows.
2. Cabinets, including open wall shelving and locks.
3. Signs, except where scheduled.
4. Toilet accessories, including grab bars.
5. Installation.
6. Rough hardware.
7. Conduit, junction boxes & wiring.
8. Folding partitions, except cylinders where detailed.
9. Sliding aluminum doors, except cylinders where detailed.
10. Access doors and panels, except cylinders where detailed.
11. Corner Guards.
12. Welded steel gates and supports.

1.2 REFERENCES:

A. Use date of standard in effect as of Bid date.

1. American National Standards Institute
   a) ANSI 156.18 – Materials and Finishes.
2. BHMA – Builders Hardware Manufacturers Association
3. 2022 California Building Code
   a) Chapter 11B – Accessibility To Public Buildings, Public Accommodations, Commercial Buildings and Public Housing
4. DHI – Door and Hardware Institute

5. NFPA – National Fire Protection Association
   a) NFPA 80 2019 Edition – Standard for Fire Doors and Other Opening Protectives.
   b) NFPA 105 – Smoke and Draft Control Door Assemblies
   c) NFPA 252 – Fire Tests of Door Assemblies
6. UL – Underwriters Laboratories
   a) UL10C – Positive Pressure Fire Tests of Door Assemblies.
   b) UL 305 – Panic Hardware
7. WHI – Warnock Hersey Incorporated State of California Building Code
8. Local applicable codes
9. SDI – Steel Door Institute
10. WI – Woodwork Institute
11. AWI – Architectural Woodwork Institute
12. NAAMM – National Association of Architectural Metal Manufacturers

B. Abbreviations

1. Manufacturers**:** see table at 2.1.A of this section
2. Finishes**:** see 2.7 of this section.

1.3 SUBMITTALS & SUBSTITUTIONS

A. SUBMITTALS**:** Submit six copies of schedule per D. Only submittals printed one sided will be accepted and reviewed. Organize vertically formatted schedule into "Hardware Sets" with index of doors and headings, indicating complete designations of every item required for each door or opening. Minimum 10pt font size. Include following information**:**

1. Type, style, function, size, quantity and finish of hardware items.
2. Use BHMA Finish codes per ANSI A156.18.
3. Name, part number and manufacturer of each item.
4. Fastenings and other pertinent information.
5. Location of hardware set coordinated with floor plans and door schedule.
6. Explanation of abbreviations, symbols, and codes contained in schedule.
7. Mounting locations for hardware.
8. Door and frame sizes, materials and degrees of swing.
9. List of manufacturers used and their nearest representative with address and phone number.
10. Catalog cuts.
11. Point-to-point wiring diagrams.
12. Manufacturer's technical data and installation instructions for electronic hardware.

B. Bid and submit manufacturer's updated/improved item if scheduled item is discontinued.

C. Deviations**:** Highlight, encircle or otherwise identify deviations from "Schedule of Finish Hardware" on submittal with notations clearly designating those portions as deviating from this section.

D. If discrepancy between drawings and scheduled material in this section, bid the more expensive of the two choices, note the discrepancy in the submittal and request direction from Architect for resolution.
E. Substitutions per Division 1. Include product data and indicate benefit to the Project. Furnish operating samples on request.
F. Items listed with no substitute manufacturers have been requested by Owner to meet existing standard.
G. Furnish as-built/as-installed schedule with closeout documents, including keying schedule, riser and point-to-point wiring diagrams, manufacturers' installation, adjustment and maintenance information, and supplier's final inspection report.

1.4 QUALITY ASSURANCE:

A. Hardware: Free of defects, blemishes and excessive play. Obtain each kind of hardware (latch and locksets, exit devices, hinges and closers) from one manufacturer.
B. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.
C. Fire-Rated Openings: NFPA 80 compliant. Hardware UL10C (positive pressure) compliant for given type/size opening and degree of label. Provide proper latching hardware, non-flaming door closers, approved-bearing hinges, and resilient seals. Coordinate with wood door section for required intumescent seals. Furnish openings complete.
D. Furnish hardware items required to complete the work in accordance with specified performance level and design intent, complying with manufacturers' instructions and code requirements.

1.5 DELIVERY, STORAGE AND HANDLING:

A. Delivery: coordinate delivery to appropriate locations (shop or field).
    1. Permanent keys and cores: secured delivery direct to Owner's representative.
B. Acceptance at Site: Items individually packaged in manufacturers' original containers, complete with proper fasteners and related pieces. Clearly mark packages to indicate contents, locations in hardware schedule and door numbers.
C. Storage: Provide securely locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, dust, excessive heat and cold, etc.

1.6 PROJECT CONDITIONS AND COORDINATION:

A. Where exact types of hardware specified are not adaptable to finished shape or size of members requiring hardware, provide suitable types having as nearly as practical the same operation and quality as type specified, subject to Architect's approval.

B. Coordination: Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents. Furnish related trades with the following information:

1. Location of embedded and attached items to concrete.
2. Location of wall-mounted hardware, including wall stops.
3. Location of finish floor materials and floor-mounted hardware.
4. At masonry construction, coordinate with the anchoring and hollow metal supplier prior to frame installation by placing a strip of insulation, wood, or foam, on the back of the hollow metal frame behind the rabbet section for continuous hinges, as well as at rim panic hardware strike locations, silencers, coordinators, and door closer arm locations. When the frame is grouted in place, the backing will allow drilling and tapping without dulling or breaking the installer's bits.
5. Coordinate: flush top rails of doors at outswinging exteriors, and throughout where adhesive-mounted seals occur.
6. Manufacturers' templates to door and frame fabricators.

C. Check Shop Drawings for doors and entrances to confirm that adequate provisions will be made for proper hardware installation.

D. Environmental considerations: segregate unused recyclable paper and paper product packaging, uninstalled metals, and plastics, and have these sent to a recycling center.

1.7 WARRANTY:

A. Part of respective manufacturers' regular terms of sale. Provide manufacturers' written warranties.

B. Include factory order numbers with close-out documents to validate warranty information, required for Owner in making future warranty claims:

C. Minimum warranties:

1.	Mortise Locksets:	Ten years
2.	Extra Heavy Duty Cylindrical Lock:	Ten Years
3.	Exit Devices:	Ten years mechanical Three years electrical
4.	Closers:	Thirty years mechanical Two years electrical
5.	Hinges:	One year
6.	Other Hardware	Two years

1.8 COMMISSIONING:

A. Conduct these tests prior to request for certificate of substantial completion:

1. With installer present, test door hardware operation with climate control system and stairwell pressurization system both at rest and while in full operation.

1.9 REGULATORY REQUIREMENTS:

A. Locate latching hardware between 34 inches to 44 inches above the finished floor, per 2022 California Building Code, Section 11B-404.2.7.

1. Panic hardware: locate between 36 inches to 44 inches above the finished floor.

B. Handles, pull, latches, locks, other operable parts:

1. Readily openable from egress side with one hand and without tight grasping, tight pinching, or twisting of the wrist to operate. 2022 California Building Code Section 11B-309.4.
2. Force required to activate the operable parts: 5.0 pounds maximum, per 2022 California Building Code Section 11B-309.4.

C. Adjust doors to open with not more than 5.0-pounds pressure to open at exterior doors and 5.0-pounds at interior doors. As allowed per 2022 California Building Code Section 11B-404.2.9, local authority may increase the allowable pressure for fire doors to achieve positive latching, but not to exceed 15-pounds.

1. Exception: exterior doors' pressure-to-open may be increased to 8.5-pounds if: at a single location, and one of a bank of eight leafs or fraction of eight, and one leaf of this bank is fitted with a low- or high-energy operator.

D. Adjust door closer sweep periods so that from an open position of 90 degrees, the door will take at least 5 seconds to move to a point 12 degrees from the latch, measured to the landing side of the door, per 2022 California Building Code Section 11B-404.2.8.

1. Spring hinges: adjust for 1.5 seconds minimum for 70 degrees to fully-closed.

E. Smooth surfaces at bottom 10 inches of push sides of doors, facilitating push-open with wheelchair footrests, per 2022 California Building Code Section 11B-404.2.10.

1. Applied kickplates and armor plates: bevel the left and right edges; free of sharp or abrasive edges.
2. Tempered glass doors without stiles: bottom rail may be less than 10 inches if top leading edge is tapered 60 degrees minimum.

F. Door opening clear width no less than 32 inches, measured from face of frame stop, or edge of inactive leaf of pair of doors, to door face with door opened to 90 degrees. Hardware projection not a factor in clear width if located above 30 inches and below 80 inches, and the hardware projects no more than 4 inches. 2022 California Building Code Section 11B-404.2.3.

1. Exception: doors not requiring full passage through the opening, that is, to spaces less than 24 inches in depth, may have the clear opening width reduced to 20 inches. Example: shallow closets.

2. Door closers and overhead stops: not less than 78 inches above the finished floor or ground, per 2022 California Building Code 11B-307.4.

G. Thresholds**:** floor or landing no more than 0.50 inches below the top of the threshold of the doorway, per 2022 California Building Code Section 11B-404.2.5. Vertical rise no more than 0.25 inches, change in level between 0.25 inches and 0.50 inches**:** beveled to slope no greater than 1**:**2 (50 percent slope). 2022 California Building Code Section 11B-303.2 & ~.3.

H. Floor stops**:** Do not locate in path of travel. Locate no more than 4 inches from walls.

I. Pairs of doors with independently-activated hardware both leafs**:** limit swing of right-hand or right-hand-reverse leaf to 90 degrees to protect persons reading wall-mounted tactile signage, per 2022 California Building Code Section 11B-703.4.2.

J. Door and door hardware encroachment**:** when door is swung fully-open into means-of-egress path, the door may not encroach/project more than 7 inches into the required exit width, with the exception of door release hardware such as lockset levers or panic hardware. These hardware items must be located no less than 34-inches and no more than 48-inches above the floor/ground. 2022 California Building Code, Section 1005.7.1.

In I-2 occupancies, surface mounted latch release hardware, mounted to the side of the door facing away from the adjacent wall where the door I sin the open position, is not exempt from the inclusion in the 7-inch maximum encroachment, regardless of its mounting height, per 2022 California Building Code, Section 1005.7.1 at Exception 1.

PART 2 PRODUCTS

2.1 MANUFACTURERS**:**

A. Listed acceptable alternate manufacturers**:** these will be considered; submit for review products with equivalent function and features of scheduled products.

ITEM**:**	MANUFACTURER**:**	ACCEPTABLE ALTERNATE**:**
Hinges	(IVE) Ives	Bommer
Continuous Hinges	(IVE) Ives	Select
Pivots	(IVE) Ives	Rixson
Floor Closers	(RIX) Rixson	Dorma
Key System	(SCH) Schlage	Owner standard
Mechanical Locks	(SCH) Schlage	Owner standard
Electronic Locks	(SCE) Schlage Electronics	Owner standard

Exit Devices	(VON) Von Duprin	Owner standard
Closers	(LCN) LCN	Owner standard
Auto Flush Bolts	(IVE) Ives	DCI
Coordinators	(IVE) Ives	DCI
Silencers	(IVE) Ives	Rockwood, Trimco
Push & Pull Plates	(IVE) Ives	Rockwood, Trimco
Kickplates	(IVE) Ives	Rockwood, Trimco
Stops & Holders	(IVE) Ives	Rockwood, Trimco
Overhead Stops	(GLY) Glynn-Johnson	ABH
Thresholds	(ZER) Zero	NGP, Pemko
Seals & Bottoms	(ZER) Zero	NGP, Pemko
Key Cabinets	(LUN) Lund	TelKee
Aluminum Door Locks	(ADA) Adams Rite	None

2.2 HINGING METHODS:

A. Drawings typically depict doors at 90 degrees, doors will actually swing to maximum allowable. Use wide-throw conventional or continuous hinges as needed up to 8 inches in width to allow door to stand parallel to wall for true 180-degree opening. Advise architect if 8-inch width is insufficient.

B. Conform to manufacturer's published hinge selection standard for door dimensions, weight and frequency, and to hinge selection as scheduled. Where manufacturer's standard exceeds the scheduled product, furnish the heavier of the two choices, notify Architect of deviation from scheduled hardware.

C. Conventional Hinges: Steel or stainless steel pins and approved bearings. Hinge open widths minimum, but of sufficient throw to permit maximum door swing.

1. Outswinging exterior doors: non-ferrous with non-removable (NRP) pins and security studs.
2. Non-ferrous material exteriors and at doors subject to corrosive atmospheric conditions.

2.3 LOCKSETS, LATCHSETS, DEADBOLTS:

A. Mortise Locksets and Latchsets: as scheduled.

1. Chassis: cold-rolled steel, handing field-changeable without disassembly.
2. Universal lock case – 10 functions in one case.
3. Floating mounting tabs automatically adjusts to fit a beveled door edge.
4. Latchbolts: 0.75 inch throw stainless steel anti-friction type.

5. Lever Trim: through-bolted, accessible design, cast lever or solid extruded bar type levers as scheduled. Filled hollow tube design unacceptable.
    a) Spindles: security design independent breakaway. Breakage of outside lever does not allow access to inside lever's hubworks to gain wrongful entry.
    b) Inside lever applied by screwless shank mounting – no exposed trim mount screws.
    c) Levers rotate up or down for ease of use.
    d) Vandalgard locks: locked lever freely rotates down while remaining securely locked. This feature prevents damage to internal lock components when subjected to excessive force.
6. Furnish solid cylinder collars with wave springs. Wall of collar to cover rim of mortise cylinder.
7. Turnpieces: accessible offset turn-lever design not requiring pinching or twisting motions to operate.
8. Deadbolts: stainless steel 1-inch throw.
9. Electric operation: Manufacturer-installed continuous duty solenoid.
10. Strikes: 16 gage curved steel, bronze or brass with 1 inch deep box construction, lips of sufficient length to clear trim and protect clothing.
11. Scheduled Lock Series and Design: Schlage L series, 17A design.
12. Certifications:
    a) ANSI A156.13, Grade 1 Operational, Grade 1 Security.
    b) ANSI/ASTM F476-84 Grade 31 UL Listed.
13. Accessibility: Require not more than 5 lb to retract the latchbolt or deadbolt, or both, per CBC 2022 11B-404.2.7 and 11B-309.4.

2.4 EXIT DEVICES / PANIC HARDWARE

A. General features:

1. Independent lab-tested 1,000,000 cycles.
2. Push-through push-pad design. No exposed push-pad fasteners, no exposed cavities when operated. Return stroke fluid dampeners and rubber bottoming dampeners, plus anti-rattle devices.
3. Deadlocking latchbolts, 0.75 inch projection.
4. End caps: impact-resistant, flush-mounted. No raised edges or lips to catch carts or other equipment.
5. No exposed screws to show through glass doors.
6. Non-handed basic device design with center case interchangeable with all functions, no extra parts required to effect change of function.
7. Releasable in normal operation with 15-pound maximum operating force per UBC Standard 10-4, and with 32-pound maximum pressure under 250-pound load to the door.
8. Exterior doors scheduled with XP-series devices: Static load force resistance of at least 2000 pounds.
9. Accessibility: Require not more than 5 lb to retract the latchbolt, per CBC 2022 11B-404.2.7 and 11B-309.4.

a) Mechanical method: Von Duprin “AX-“ feature, where touchpad directly retracts the latchbolt with 5 lb or less of force. Provide testing lab certification confirming that the mechanical device is independent third-party tested to meet this 5 lb requirement.
b) Electrical method: Von Duprin’s “RX-QEL-“, where lightly pressing the touchpad with 5 lb or less of force closes an electric switch, activating quiet electric latch retraction.

B. Specific features**:**

1. Non-Fire Rated Devices**:** cylinder dogging.
2. Lever Trim**:** breakaway type, forged brass or bronze escutcheon min. 0.130 inch thickness, compression spring drive, match lockset lever design.
3. Rod and latch guards with sloped full-width kickplates for doors fitted with surface vertical rod devices with bottom latches.
4. Fire-Labeled Devices**:** UL label indicating “Fire Exit Hardware”. Vertical rod devices less bottom rod (LBR) unless otherwise scheduled.
5. Inpact recessed devices**:** 1.25 inch projection when push-pad is depressed. Sloped metal end caps to deflect carts, etc. No pinch points to catch skin between touchbar and door.
6. Delayed Egress Devices**:** Function achieved within single exit device component, including latch, delayed locking device, request-to-exit switch, nuisance alarm, remote alarm, key switch, indicator lamp, relay, internal horn, door position input, external inhibit input plus fire alarm input. NFPA 101 “Special Locking Arrangement” compliant.
7. Electrically Operated Devices**:** Single manufacturer source for electric latch retraction devices, electrically controlled trim, power transfers, power supplies, monitoring switches and controls.
8. Removable Mullions**:** Removable with single turn of building key. Securely reinstalled without need for key. Furnish storage brackets for securely stowing the mullion away from the door when removed.
9. Accepted substitutions: None

2.6 CLOSERS

A. Surface Closers**:**

1. Full rack-and-pinion type cylinder with removable non-ferrous cover and cast iron body. Double heat-treated pinion shaft, single piece forged piston, chrome-silicon steel spring.
2. ISO 2000 certified. Units stamped with date-of-manufacture code.
3. Independent lab-tested 10,000,000 cycles.
4. Non-sized, non-handed, and adjustable. Place closer inside building, stairs, and rooms.
5. Plates, brackets and special templating when needed for interface with particular header, door and wall conditions and neighboring hardware.
6. Adjust doors to open with not more than 5.0-pounds pressure to open at exterior doors and 5.0-pounds at interior doors. As allowed per 2022 California Building Code Section 11B-404.2.9, local authority may increase the allowable pressure for fire doors to achieve positive latching, but not to exceed 15-pounds.

a) Exception: exterior doors' pressure-to-open may be increased to 8.5-pounds if: at a single location, and one of a bank of eight leafs or fraction of eight, and one leaf of this bank is fitted with a low- or high-energy operator.

7. Separate adjusting valves for closing speed, latching speed and backcheck, fourth valve for delayed action where scheduled.
8. Extra-duty arms (EDA) at exterior doors scheduled with parallel arm units.
9. Exterior door closers**:** tested to 100 hours of ASTM B117 salt spray test, furnish data on request.
10. Exterior doors**:** seasonal adjustments not required for temperatures from 120 degrees F to -30 degrees F, furnish checking fluid data on request.
11. Non-flaming fluid, will not fuel door or floor covering fires.
12. Pressure Relief Valves (PRV) not permitted.
13. Accepted substitutions: None

2.7 OTHER HARDWARE

A. Automatic Flush Bolts**:** Low operating force design.

B. Overhead Stops**:** Non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions.

C. Kick Plates**:** Four beveled edges, .050 inches minimum thickness, height and width as scheduled. Sheet-metal screws of bronze or stainless steel to match other hardware.

D. Door Stops**:** Provide stops to protect walls, casework or other hardware.

14. Unless otherwise noted in Hardware Sets, provide wall type with appropriate fasteners. Where wall type cannot be used, provide floor type. If neither can be used, provide overhead type.
15. Locate overhead stops for maximum possible opening. Consult with Owner for furniture locations. Minimum**:** 90deg stop / 95deg deadstop. Note degree of opening in submittal.

E. Thresholds**:** As scheduled and per details. Comply with CBC 2022 11B-404.2.5. Substitute products**:** certify that the products equal or exceed specified material's thickness. Proposed substitutions**:** submit for approval.

1. Saddle thresholds**:** 0.125 inches minimum thickness.
2. Exteriors**:** Seal perimeter to exclude water and vermin. Use sealant complying with requirements in Division 7 "Thermal and Moisture Protection". Minimum 0.25 inch diameter fasteners and lead expansion shield anchors, or Red-Head #SFS-1420 (or approved equivalent) Flat Head Sleeve Anchors. National Guard Products' "COMBO" or Pemko Manufacturing's "FHSL".
3. Fire-rated openings, 90-minutes or less duration**:** use thresholds to interrupt floor covering material under the door where that material has a critical radiant flux value less than 0.22 watts per square centimeter, per NFPA 253. Use threshold unit as scheduled. If none scheduled, include a 0.25in high 5in wide saddle in the bid, and request direction from Architect.
4. Fire-rated openings, 3-hour duration**:** Thresholds, where scheduled, to extend full jamb depth.

5. Plastic plugs with wood or sheet metal screws are not an acceptable substitute for specified fastening methods.
6. Fasteners: Generally, exposed screws to be Phillips or Robertson drive. Pinned TORX drive at high security areas. Flat head sleeve anchors (FHSL) may be slotted drive. Sheet metal and wood screws: full-thread. Sleeve nuts: full length to prevent door compression.

F. Through-bolts: Do not use. Coordinate with wood doors; ensure provision of proper blocking to support wood screws for mounting panic hardware and door closers. Coordinate with metal doors and frames; ensure provision of proper reinforcement to support machine screws for mounting panic hardware and door closers.

1. Exception: surface-mounted overhead stops, holders, and friction stays.

G. Silencers: Interior hollow metal frames, 3 for single doors, 4 for pairs of doors. Leave no unfilled/uncovered pre-punched silencer holes. Intent: door bears against silencers, seals make minimal contact with minimal compression – only enough to effect a seal.

2.8 FINISH:

A. Generally: BHMA 626 Satin Chromium.

1. Areas using BHMA 626: furnish push-plates, pulls and protection plates of BHMA 630, Satin Stainless Steel, unless otherwise scheduled.

B. Door closers: factory powder coated to match other hardware, unless otherwise noted.

à A. Everest [D] Primus[XP]: IC throughout:

2.9 KEYING REQUIREMENTS:

A. Key System: (Verify with owner) Schlage Primus high-security utility-patented keyway, interchangeable core throughout. Utility patent protection to extend at least until 2029. Key blanks available only from factory-direct sources, not available from after-market keyblank manufacturers. For estimate use factory GMK charge. Initiate and conduct meeting(s) with Owner to determine system keyway(s), keybow styles, structure, stamping, degree of physical security and degree of geographic exclusivity. Furnish Owner's written approval of the system; do not order keys or cylinders without written confirmation of actual requirements from the Owner. Owner will install permanent cylinders/cores.

1. Existing factory-registered master key system.
2. Construction keying: furnish temporary keyed-alike cores. Remove at substantial completion and install permanent cylinders/cores in Owner's presence. Demonstrate that construction key no longer operates.
3. Temporary cylinders/cores remain supplier's property.
4. Furnish 10 construction keys.
5. Furnish 2 construction control keys.
6. Key Cylinders: furnish 6-pin solid brass construction.

B. Cylinders/cores: keyed at factory of lock manufacturer where permanent records are maintained. Locksets and cylinders same manufacturer.

C. Permanent keys: use secured shipment direct from point of origination to Owner.

1. For estimate: 3 keys per change combination, 5 master keys per group, 5 grand-master keys, 3 control keys.
2. For estimate: VKC stamping plus “DO NOT DUPLICATE”.

D. Bitting List: use secured shipment direct from point of origination to Owner at completion.

PART 3 - EXECUTION

3.1 ACCEPTABLE INSTALLERS:

A. Can read and understand manufacturers’ templates, suppliers’ hardware schedule and printed installation instructions. Can readily distinguish drywall screws from manufacturers’ furnished fasteners. Available to meet with manufacturers’ representatives and related trades to discuss installation of hardware.

3.2 PREPARATION:

A. Ensure that walls and frames are square and plumb before hardware installation. Make corrections before commencing hardware installation. Installation denotes acceptance of wall/frame condition.

A. Locate hardware per SDI-100 and applicable building, fire, life-safety, accessibility, and security codes.

1. Notify Architect of code conflicts before ordering material.
1. Locate latching hardware between 34 inches to 44 inches above the finished floor, per California Building Code, Section 1010.1.9.2 and 11B-404.2.7.
2. Locate panic hardware between 36 inches to 44 inches above the finished floor.
3. Where new hardware is to be installed near existing doors/hardware scheduled to remain, match locations of existing hardware.

B. Overhead stops: before installing, determine proposed locations of furniture items, fixtures, and other items to be protected by the overhead stop's action.

C. Existing frames and doors to be retrofitted with new hardware:

1. Field-verify conditions and dimensions prior to ordering hardware. Fill existing hardware cut outs not being reused by the new hardware. Remove existing hardware not being reused, return to Owner unless directed otherwise.
2. Remove existing floor closers not scheduled for reuse, fill cavities with non-shrinking concrete and finish smooth.
3. Cut and weld existing steel frames currently prepared with 2.25 inch height strikes. Cut an approximate 8 inch section from the strike jamb and weld in a reinforced section to accommodate specified hardware’s strike.
4. Patch and weld flush filler pieces into existing door hardware preparations in steel doors and frames, leave surfaces smooth.

5. Glue in solid wood block fillers to fill cut outs in existing wood doors, sand surfaces smooth. Alternatively, use an approved epoxy-based wood filler product, submit product data for approval.

3.3 INSTALLATION

A. Install hardware per manufacturer's instructions and recommendations. Do not install surface-mounted items until finishes have been completed on substrate. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate for proper installation and operation. Remove and reinstall or replace work deemed defective by Architect.

1. Gaskets**:** install jamb-applied gaskets before closers, overhead stops, rim strikes, etc; fasten hardware over and through these seals. Install sweeps across bottoms of doors before astragals, cope sweeps around bottom pivots, trim astragals to tops of sweeps.
2. When hardware is to be attached to existing metal surface and insufficient reinforcement exists, use RivNuts, NutSerts or similar anchoring device for screws.
3. Use manufacturers' fasteners furnished with hardware items, or submit Request for Substitution with Architect.
4. Replace fasteners damaged by power-driven tools.

B. Locate floor stops no more that 4 inches from walls and not within paths of travel. See paragraph 2.2 regarding hinge widths, door should be well clear of point of wall reveal. Point of door contact no closer to the hinge edge than half the door width. Where situation is questionable or difficult, contact Architect for direction.

C. Core concrete for exterior door stop anchors. Set anchors in approved non-shrink grout.

D. Locate overhead stops for minimum 90 degrees at rest and for maximum allowable degree of swing.

E. Drill pilot holes for fasteners in wood doors and/or frames.

F. Lubricate and adjust existing hardware scheduled to remain. Carefully remove and give to Owner items not scheduled for reuse.

G. Field-verify existing conditions and measurements prior to ordering hardware. Fill existing hardware cut outs not being used by the new hardware.

H. Remove existing hardware not being reused. Tag and bag removed hardware, turn over to Owner.

I. Where existing wall conditions will not allow door to swing using the scheduled hinges, provide wide-throw hinges and if needed, extended arms on closers.

3.4. ADJUSTING

A. Adjust and check for proper operation and function. Replace units, which cannot be adjusted to operate freely and smoothly.

1. Hardware damaged by improper installation or adjustment methods**:** repair or replace to Owner's satisfaction.
2. Adjust doors to fully latch with no more than 1 pound of pressure.

a) Door closer valves: turn valves clockwise until at bottom – do not force. Turn valves back out one and one-half turns and begin adjustment process from that point. Do not force valves beyond three full turns counterclockwise.

3. Adjust delayed-action closers on fire-rated doors to fully close from fully-opened position in no more than 10 seconds.
4. Adjust door closers per 1.9 this section.

B. Inspection of fire door assemblies and means-of-egress panic-hardware doors**:** Per 2019 NFPA-80 5.2.1: hire an independent third-party inspection service to prepare a report listing these doors, and include a statement that there are zero deficiencies with the fire-rated assemblies and the openings with panic hardware.
1. Per 2019 NFPA-80 5.2.1: Use a third party inspector not associated with the construction, supply or installation of this project to develop a field survey of the doors and hardware. Survey is to be done by a member certified as a FDAI (Fire Door Assembly Inspector), Certified AHC (Architectural Hardware Consultant) or a certified testing laboratory: UL or Intertek. Certified Inspectors may be found at DHI.org, Intertek, or CAFDI.org.

C. Fire-rated doors**:**
1. Wood doors**:** adjust to 0.125 inches clearance at heads, jambs, and meeting stiles.
2. Steel doors**:** adjust to 0.063 inches minimum to 0.188 inches maximum clearance at heads, jambs, and meeting stiles.
3. Adjust wood and steel doors to 0.75 inches maximum clearance (undercut) above threshold or finish floor material under door.

D. Final inspection**:** Installer to provide letter to Owner that upon completion installer has visited the Project and has accomplished the following**:**
1. Has re-adjusted hardware.
2. Has evaluated maintenance procedures and recommend changes or additions, and instructed Owner's personnel.
3. Has identified items that have deteriorated or failed.
4. Has submitted written report identifying problems.

3.5 DEMONSTRATION**:**

A. Demonstrate mechanical hardware and electrical, electronic and pneumatic hardware systems, including adjustment and maintenance procedures.

3.6 PROTECTION/CLEANING**:**

A. Cover installed hardware, protect from paint, cleaning agents, weathering, carts/barrows, etc. Remove covering materials and clean hardware just prior to substantial completion.

B. Clean adjacent wall, frame and door surfaces soiled from installation / reinstallation process.

3.7 SCHEDULE OF FINISH HARDWARE

A. See door schedule in drawings for hardware set assignments.
B. Do not order material until submittal has been reviewed, stamped, and signed by Architect's door hardware consultant.
C. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

OVERTUR 113969 V1 /OPT0377098

HARDWARE GROUP NO. 01
For use on Door #(s):
101
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	L9010 17A	626	SCH
1	EA	OH STOP	90S	630	GLY
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	695	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 02
For use on Door #(s):
102
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	L9080T 17A	626	SCH
1	EA	PRIMUS CORE	20-740-XP	626	SCH
1	EA	OH STOP	90S	630	GLY
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	695	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 03
For use on Door #(s):
103
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	HINGE	5BB1 5 X 4.5		652	IVE
1	EA	ELECTRIC HINGE	5BB1 5 X 4.5 CON TW4	✓	652	IVE
1	EA	EU MORTISE LOCK	L9092TEU 17A CON 12/24 VDC	✓	626	SCH
1	EA	PRIMUS CORE	20-740-XP		626	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ		695	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	MOP PLATE	8400 4" X 1" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	WIRE HARNESS (DOOR)	CON-___ (LENGTH AS REQUIRED)	✓		SCH
1	EA	WIRE HARNESS (FRAME)	CON-6W	✓		SCH
1		CARD READER	CARD READER - WORK OF DIVISION 28			
1	EA	POWER SUPPLY	POWER SUPPLY BY DIVISION 28			BYO

HARDWARE GROUP NO. 04
For use on Door #(s):
104 106 108
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	ELECTRIC HINGE	5BB1 4.5 X 4.5 CON TW4	✓	652	IVE
1	EA	EU MORTISE LOCK	L9092TEU 17A CON 12/24 VDC	✓	626	SCH
1	EA	PRIMUS CORE	20-740-XP		626	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ		695	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	MOP PLATE	8400 4" X 1" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	WIRE HARNESS (DOOR)	CON-___ (LENGTH AS REQUIRED)	✓		SCH
1	EA	WIRE HARNESS (FRAME)	CON-6W	✓		SCH
1		CARD READER	CARD READER - WORK OF DIVISION 28			
1	EA	POWER SUPPLY	POWER SUPPLY BY DIVISION 28			BYO

HARDWARE GROUP NO. 05
For use on Door #(s):
105 111
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	L9010 17A	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 06
For use on Door #(s):
107 110 112
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	L9010 17A	626	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	695	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 07
For use on Door #(s):
109 201 202
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR W/ INSIDE INDICATOR	L9040 17A 09-544 OS-OCC IS-LOC	626	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	695	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	MOP PLATE	8400 4" X 1" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 08
For use on Door #(s):
114 203
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	L9010 17A	626	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	695	LCN
1	EA	KICK PLATE	8402 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488FSBK PSA	BK	ZER

HARDWARE GROUP NO. 09
For use on Door #(s):
204 205 206 207
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR W/ INSIDE INDICATOR	L9040 17A 09-544 OS-OCC IS-LOC	626	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	695	LCN
1	EA	KICK PLATE	8402 10" X 2" LDW B-CS	630	IVE
1	EA	MOP PLATE	8402 4" X 1" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488FSBK PSA	BK	ZER

HARDWARE GROUP NO. 10
For use on Door #(s):
E106 E114B
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	LD-AX-98-EO	626	VON
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	695	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	RAIN DRIP	142AA AS REQUIRED	AA	ZER
1	SET	GASKETING	328AA-S (AT JAMB LEGS)	AA	ZER
1	SET	GASKETING	429AA-S AT HEAD	AA	ZER
1	EA	THRESHOLD	THRESHOLD AS DETAILED		
1	EA	DOOR SWEEP	39A	A	ZER

HARDWARE GROUP NO. 11
For use on Door #(s):
E112
Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP		630	IVE
1	EA	REMOVABLE MULLION	KR4954 STAB		SP28	VON
2	EA	PANIC HARDWARE	LD-AX-98-EO		626	VON
1	EA	MORTISE CYLINDER	20-061-ICX FOR MULLION		626	SCH
1	EA	PRIMUS CORE	20-740-XP		626	SCH
2	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ		695	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
2	EA	FLOOR STOP	FS18S		BLK	IVE
1	EA	RAIN DRIP	142AA AS REQUIRED		AA	ZER
1	SET	GASKETING	328AA-S (AT JAMB LEGS)		AA	ZER
1	SET	GASKETING	429AA-S AT HEAD		AA	ZER
1	EA	MULLION SEAL	8780NBK PSA		BK	ZER
1	EA	THRESHOLD	THRESHOLD AS DETAILED			
2	EA	DOOR SWEEP	39A		A	ZER

HARDWARE GROUP NO. 12
For use on Door #(s):
E114A
Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	ELECTRIC HINGE	5BB1HW 4.5 X 4.5 CON TW12	✓	630	IVE
1	EA	ELEC PANIC HARDWARE	QELX-AX-98-L-NL-17-CON	✓	626	VON
1	EA	RIM CYLINDER	20-057 ICX		626	SCH
1	EA	PRIMUS CORE	20-740-XP		626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH		695	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	RAIN DRIP	142AA AS REQUIRED		AA	ZER
1	SET	GASKETING	328AA-S (AT JAMB LEGS)		AA	ZER
1	SET	GASKETING	429AA-S AT HEAD		AA	ZER
1	EA	THRESHOLD	THRESHOLD AS DETAILED			
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	WIRE HARNESS (DOOR)	CON-___ (LENGTH AS REQUIRED)	✓		SCH
1	EA	WIRE HARNESS (FRAME)	CON-6W	✓		SCH
1	EA	POWER SUPPLY	PS902 900-2RS 900-BBK 120/240 VAC	✓		VON
1		CARD READER	CARD READER - WORK OF DIVISION 28			

POWER SUPPLY TO BE SUPPLIED AND INSTALLED BY DIVISION 28

Maintenance Materials, provide the following:

- As-built hardware schedule
- Copies of warranty information for each hardware type
- Binder of catalog cuts or complete catalog sections of items used, installation and maintenance/adjustment information.
- Collection of tools that were included with the hardware: wrenches, drivers, etc.

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SCOPE OF WORK SUMMARY

Supply and install all Material and Labor, as shown on Drawings and as specified herein, including all accessories and hardware for a timely, complete, and proper installation:

A. High-performance architectural glass.
B. High-performance insulating glass.

1.03 STANDARDS AND REFERENCES

A. ANSI Z97.1 – American National Standard for Glazing Materials Used in Buildings – Safety Performance Specifications and Methods of Test
B. CPSC 16 CFR 1201 – Safety Standard for Architectural Glazing Materials
C. Glazing Publications: Comply with published recommendations of glass product manufacturers and industry organizations, including but not limited to those below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
    1. IGMA Publication for Insulating Glass: IGMA TM-3000, Glazing Guidelines for Sealed Insulating Glass Units.
    2. GANA Publications: Laminated Glazing Reference Manual; Glazing Manual.
D. ASTM International:
    1. ASTM C162 – Standard Terminology of Glass and Glass Products.
    2. ASTM C1036 – Standard Specification for Flat Glass.
    3. ASTM C1048 – Standard Specification for Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated Glass.
    4. ASTM C1172 – Standard Specification for Laminated Architectural Flat Glass.
    5. ASTM C1376 – Standard Specification for Pyrolitic and Vacuum Deposition Coatings on Flat Glass.
    6. ASTM E2188 – Standard Test Method for Insulating Glass Unit Performance.
    7. ASTM E2189 – Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units.
    8. ASTM E2190 – Standard Specification for Insulating Glass Unit Performance and Evaluation.

1.04 QUALITY ASSURANCE

A. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
B. Source Limitation for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.
C. Glass Product Testing: Obtain glass test results for product test reports in Submittals Article from a qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program

D. Safety Glazing Labeling: Permanently mark glazing with certification label indicating manufacturer's name, type of glass, glass thickness and safety glazing standard with which glass complies.
E. Installer Qualifications: An experienced installer who has completed glazing similar in material, design and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association Glazier Certification Program.

1.05 SUBSTITUTIONS

Substitutions will be considered per Section 01 25 00 Substitution Procedures.

1.06 SUBMITTALS

A. Provide in accordance with Section 01 33 00 Submittal Procedures.
B. Provide for each glass type:
    1. Latest edition of manufacturer's Technical Data including structural, physical and environmental characteristics, size limitations, and special handling or installation requirements.
    2. Product Certificates from manufacturer.
    3. Product Test Reports for: Tinted Float Glass, Coated Float Glass, and Insulating Glass.
    4. Submit two, 12"x12" samples, illustrating glass unit and coloration.
C. Provide data, including VOC content on glazing sealant. Identify colors available.
D. Provide shop drawings: Submit shop drawings showing layout, profiled and product components.

1.07 DELIVERY, STORAGE AND HANDLING

A. Comply with the requirements of Section 01 66 00 Product Storage and Handling Requirements.
B. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.08 PROJECT CONDITIONS

A. Comply with the requirements of Section 01 50 00 Construction Facilities.
B. Environmental Limitations: Do not deliver or install fire-resistant glazing until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature conditions at occupancy levels during the remainder of the construction period.

1.09 WARRANTY

A. Provide Manufacturers Standard Warranty in accordance with Section 01 78 36 Warranties.
B. Contractor shall guarantee the work covered by this specification against all defects in material and workmanship for a period of not less than FIVE (5) years. Include coverage of sealed glass units from seal failure, interpane dusting or misting, and replacement.

PART 2 – PRODUCTS

2.01 ACCEPTABLE GLASS MANUFACTURERS

A. Insulated, Laminated, and Spandrel Glass: Vitro Architectural Glass (formerly PPG Industries), Tel: (800) 377-5267, Website: www.vitroglazings.com.
B. Security Glazing: Nippon Electric Glass Company, Ltd.; Tel: (800) 426-0279.
C. Fire-Rated Clear Window and/or Door/Sidelight Glazing: SAFTI FIRST, Tel: (888) 653-3333, Website www.safti.com.

D. Spandrel Coatings: ICD High Performance Coatings, Tel: (360) 546-2286, website: www.icdcoatings.com.

2.02 GLASS MATERIALS

A. General Performance Requirement: Installed glazing systems shall withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; deterioration of glazing materials; or other defects in construction.

B. GE-1: Exterior Glazing Type 1, Insulated Glass Units.
   1. Unit Makeup: Double pane of 1/4" (6mm) outboard lite and 1/4" (6mm) inboard lite with edge seal; 1/2" (12mm) spacer purged with dry hermetic air; total unit thickness of 1 inch.
   2. Glass Strength: Tempered as required by codes or as required to meet thermal stress and wind loads.
   3. Coating: Low-E Coating on inside of outer layer (#2 surface).
   4. Tinting: As indicated on the Drawings.
   5. Spandrel Coating: As indicated on the Drawings.
   6. Performance values based on combination of coating and/or tint selected.

C. GI-5: Exterior Bullet-resistant Glazing (typical unless noted otherwise in separate Section)
   1. Unit Makeup: Four-ply polycarbonate laminate comprised of a 1/8" (3mm) abrasion resistant polycarbonate sheet outer ply, two 1/2" (12mm) polycarbonate intermediate sheets, 1/8" (3mm) abrasion resistant polycarbonate sheet inner ply with a interlayer of .025 polyurethane between each ply.
   2. Style: Clear, unless noted otherwise.
   3. Ballistic rating Level 3 in accordance with UL 752.

D. GI-1: Interior Glazing Type 1
   1. Unit Makeup: Monolithic pane of 1/4" (6mm) lite.
   2. Glass Strength: Tempered (Grade B)
   3. Style: Clear, Uncoated, Type I (float or plate).

E. GI-2: Interior Glazing Type 2, Fire-Rated
   1. Unit Makeup: Monolithic pane as required per Fire-Rated Assembly.
      a. Nominal thickness per Fire Rating:
         i. 1/4" (6mm) = 20 minute
         ii. 3/4" (19mm) = 45 minute
         iii. 7/8" (23mm) = 60 minute
         iv. 1 7/16" (37mm) = 90 minute
         v. 2 1/8" (54mm) = 120 minute
   2. Glass Strength: Tempered. Safety rated in accordance with ANSI Z97.1 and CPSC 16 CFR 1201 Cat. I & II.
   3. Style: Clear, float glass.
   4. Fire protective tested in accordance with NFPA 80, NFPA 252, NFPA 257, UL 9, UL 10B and UL10C.

2.03 GLAZING ACCESSORIES

A. Select appropriate glazing sealants, tapes, gaskets and other glazing materials of proven compatibility with other materials that they contact. These include glass products, insulating glass unit seals and glazing channel substrates under installation and service conditions, as demonstrated by testing and field experience. Provide fire-rated products approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection rating indicated.
B. Glazing Compound: Modified oil type, non-hardening, knife grade consistency.
C. Butyl Sealant: Single component; Shore-A hardness of 10-20; black color; non-skinning.
D. Acrylic Sealant: Single component, solvent curing, cured Shore hardness, non-bleeding.
E. Silicone Sealant: Single component, non-bleeding, non-staining; capable of water immersion without loss of properties.
F. Setting Blocks: Neoprene; 80-90 Shore A durometer hardness; 4 inch minimum long x 1/4 inch thick.
G. Spacer Shims: Neoprene; 40-50 Shore A durometer hardness; 4 inch long on 18 inch centers for wet-glazed systems.
H. Glazing Clips: Manufacturer's standard type.

PART 3 – EXECUTION

3.01 EXAMINATION
A. Examine the area and conditions under which work of this Section will be performed and confirm site conditions are acceptable for installation of the glass.
B. Coordinate work with other trades as needed to assure that proper substrate are provided to receive work of this Section.
C. Verify openings for glazing are correctly sized and within tolerance.
D. Verify surfaces of glazing channels or recesses are clean, square in plane, free of obstructions, and ready for work of this Section.
E. Verify that a functioning weep system is present.
F. Correct conditions detrimental to timely and proper completion of the Work.
G. Do not proceed until unsatisfactory conditions are corrected.
H. Beginning of installation means acceptance of conditions.

3.02 PREPARATION
A. Protect glazing products by handling and storing units according to manufacturer's recommendations.
B. Clean and prepare glazing channels and other framing members to receive glass.
C. Remove coatings and other harmful materials that will prevent glass and glazing installation required to comply with performance criteria specified.
D. Seal porous glazing channels or recesses.

3.03 EXTERIOR WET METHOD (SEALANT AND SEALANT)
A. Place setting blocks at 1/4 points and install glass pane.
B. Install removable stops with pane centered in space by inserting spacer shims both sides at 18-inch intervals, 1/4 inch below sightline.
C. Fill gap between pane and stops with sealant to depth equal to bite of frame on pane, but not more than 3/8 inch below sightline.

D. Apply sealant to uniform line, flush with sightline. Tool or wipe sealant surface with solvent for smooth appearance. Security Glazing to be sealed with security sealant as recommended by manufacturer.
E. Drain or weep the sill of each opening to the outdoors at three points using 3/8-inch diameter weep holes or the equivalent.

3.04 INTERIOR COMBINATION METHOD (TAPE AND SEALANT)

A. Cut glazing tape to length and install against permanent stops, project 1/16 inch above sightline.
B. Place setting blocks at 1/4 points.
C. Rest glass on setting blocks and push against tape to ensure full contact at perimeter of pane.
D. Install: removable stops, spacer shims between glass, and applied stops at 18-inch intervals 1/4 inch below sightline.
E. Fill gap between pane and applied stop with sealant to depth equal to bite of frame on pane to uniform and level line.
F. Trim protruding tape edge.

3.05 INTERIOR WET METHOD (COMPOUND AND COMPOUND)

A. Install glass resting on setting blocks. Install applied stop and center pane by use of spacer shims at 18-inch centers, kept 1/4 inch below sightline.
B. Locate and secure glass pane using glaziers' clips.
C. Fill gaps between pane and stops with glazing compound until flush with sightline.

3.06 CLEANING

A. After installation, mark pane with an "X" by using plastic tape or removable paste.
B. Remove glazing materials from finish surfaces.
C. Remove labels after work is completed.
D. Clean excess sealant or compound from glass and framing members immediately after application using solvents or cleaners recommended by manufacturers. Final cleaning and polishing shall be done prior to final inspection.
E. Do not use scrapers or other metal tools to clean glass.
F. Remove and replace broken, scratched, chipped or otherwise defective glass with new materials and leave the entire installation in a neat, clean, and acceptable condition.

END OF SECTION

SECTION 09 05 61.13

MOISTURE VAPOR EMISSION CONTROL

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SCOPE OF WORK SUMMARY

A. Pre-formed moisture suppression membrane installed over concrete subfloor as a floor covering underlayment.
B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
C. Coordinate the work of this section and directly related sections with concrete floor construction and repair.
D. Coordinate the work of this section and directly related sections with finish flooring work.

1.03 REFERENCES

ASTM International

A. D2646-05- Standard test Methods for Backing Fabric Characteristics of Pile Yarn Floor Coverings
B. D3273-00- Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
C. D5729-97 (2004)e1 – Standard Test Method for Thickness of Nonwoven Fabrics
D. E-96-05 – Standard Test Methods for Water Vapor Transmission of Materials
E. F 2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes
F. F 710 - Standard Practice Preparing Concrete Floors

1.04 QUALITY ASSURANCE

Comply with the Standard requirements established by Manufacturer.

1.05 SUBSTITUTIONS

Substitutions will be considered per Section 01 25 00 Substitution Procedures.

1.06 SUBMITTALS

A. Provide in accordance with Section 01 33 00 Submittal Procedures.
B. Product Data: Provide data indicating any product characteristics, performance criteria, and limitations of use.
C. Manufacturer's Current Instructions.
D. Manufacturer's warranty registration with concrete subfloor moisture test results and building ambient air temperature and relative humidity test results.

1.07 DELIVERY, STORAGE, AND HANDLING

Comply with the requirements of Section 01 66 00 Product Storage and Handling Requirements.

1.08 PROJECT CONDITIONS

A. Comply with the requirements of Section 01 50 00 Construction Facilities.
B. Comply with Manufacturer's Standard Requirements.

1.09 WARRANTY

A. Provide Manufacturer's Standard Warranty in accordance with Section 01 78 36 Warranties.
B. Provide Warranty duration based upon requirements of Flooring.

PART 2 – PRODUCTS

2.01 MANUFACTURER

Basis of Design: GCP Applied Technologies Inc. Kovara 95 & MBX (formerly VersaShield 95 & VersaShield MBX). Location: 62 Whittemore Avenue, Cambridge, MA 02140. Phone: 866-333-3726. Website: www.gcpat.com

2.02 MOISTURE SUPPRESSION SYSTEM FOR FLOORING PRODUCTS

A. Product name: Kovara 95 Flooring Underlayment and Kovara MBX Flooring Underlayment.
    1. Material: Free-standing, dimensionally stable, 4-ply composite product, engineered as a moisture suppression membrane to be used on concrete floors where high moisture exists.
    2. Dimensions: 144 ft. long by 5 ft. wide standard roll.
    3. Mold, Mildew & Fungal Resistance, ASTM D3273: 10 rating
    4. Moisture Vapor Transmission rate, ASTM E96-05: less than 0.01 g/hr/sq m
B. Accessories: Kovara Double-Sided Seam Tape
    1. Application: Joining of moisture suppression underlayment seams.
    2. Description: Membrane manufacturer's moisture suppression tape with double-sided pressure sensitive adhesive for use over slabs with a maximum relative humidity of 99.5 percent and maximum pH of 12.
    3. Properties: Moisture suppression and adhesion per manufacturer's specifications.
    4. Dimensions: 4 inch wide by 100 feet long roll.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify internal RH of the Concrete Sub Floor according to ASTM F-2170.
    1. Record readings and submit with manufacturer's warranty registration.
    2. Kovara 95: Do not install if relative humidity levels within the concrete exceed 95% Relative Humidity.
    3. Kovara MBX: Do not install if relative humidity levels within the concrete exceed 99% Relative Humidity.

3.02 PREPARATION

New or Remedial Installation - Concrete Sub Floor:

A. Prepare floor according to Kovara 95 or Kovara MBX manufacturer's instructions including removal of existing materials on concrete surface, grinding protrusions flat, and filling low spots with water-resistant cementitious patching or leveling compound. Patch cracks greater than 1/8-in. width using VersaShield manufacturer's approved crack mending compound.
B. Remove debris and excessive dust from the surface.

3.03 UNDERLAYMENT INSTALLATION

A. Install moisture suppression membrane with smooth film side facing concrete slab.
B. Install in accordance with membrane manufacturer's current written installation instructions.
C. If any jobsite condition interferes with compliance with manufacturer's instructions, contact manufacturer and obtain written job-specific procedures. Notify architect or owner's representative as required in the Quality Section of this project manual describing the interfering jobsite condition and manufacturer's job-specific instructions.

3.04 FLOORING INSTALLATION

A. Adhesives - Apply adhesive to mineral-coated surface of moisture suppression membrane. Use only water-based adhesives. Do not use solvent-based adhesives.
B. Protection - Protect moisture suppression membrane from damage during flooring installation. Do not tear, rip, puncture, or delaminate membrane when applying trowel-on adhesive. Repair damaged areas according to membrane manufacturer's instructions before flooring installation. Provide continuous, intact moisture suppression membrane under entire designated flooring area.
C. Install flooring according to flooring manufacturer's instructions
    1. Laminate or Engineered Wood: Install according to manufacturer's instructions for floating floors.
    2. Broadloom Carpet or Carpet Tiles: Adhere directly to moisture suppression membrane using carpet manufacturer's recommended adhesive.
    3. Vinyl Tile: Adhere directly to moisture suppression membrane using tile manufacturer's recommended adhesive.
    4. Ceramic Tile: Adhere only to approved surfaces - concrete, plywood, precast flooring, gypcrete, radiant heated floors, existing well-bonded vinyl, VCT, LVT, LVP, metal floors, and chemically treated or contaminated surfaces.
D. Not approved for unitary back direct glue wide width carpet, linoleum, rubber tile, sheet vinyl, mechanically fastened solid wood.

END OF SECTION

SECTION 09 21 13

PLASTER ASSEMBLIES

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS
Division 0, Contract Requirements and Division 1, General Requirements apply to this Section

1.02 SCOPE OF WORK
Supply and install all Lath and Plaster Work as shown on the Drawings and as specified herein, for a complete and proper installation.

1.03 REFERENCE STANDARDS
Comply with all applicable requirements of the California Lathing and Plastering Contractor's Association "Reference Specifications" except where more stringent requirements are indicated herein or in local building codes.

1.04 QUALITY ASSURANCE
A. In all Work under this Section, coordinate with all other trades whose work connects with, is affected or concealed by lathing and plastering. Before proceeding, make certain all required inspections have been made. Do all cutting and patching required to accommodate the work of other trades.
B. Inspect surfaces to receive lath and plaster before starting Work and do not start until surfaces are acceptable. Starting Work under this Section implies acceptance of surfaces.

1.05 SUBSTITUTIONS
Substitutions will be considered per Section 01 25 00 Substitution Procedures.

1.06 SUBMITTALS
A. Prove in accordance with Section 01 33 00 Submittal Procedures.
B. Submit Product Data and color samples and manufacturers application data.
C. Make (2) samples, at least one-foot square, of selected specified plaster system.

1.07 DELIVERY, STORAGE AND HANDLING
A. Comply with the requirements of Section 01 66 00 Product Storage and Handling Requirements.
B. Deliver all manufactured materials in original packages bearing manufacturer's name and brand. Use only one brand of each material throughout job. Store materials in dry areas.

1.08 PROJECT CONDITIONS
A. Comply with the requirements of Section 01 50 00 Construction Facilities.
B. Comply with Manufacturer’s Standard Requirements.

1.09 WARRANTY
Provide Manufacturer’s Standard Warranty in accordance with Section 01 78 36 Warranties.

PART 2 – PRODUCTS

2.01 LATH

Paperbacked Lath: K-Lath Corporation: "Aqua K-Lath", or as approved by Architect, 16 gauge wires spaced 1-1/2 inches o.c. vertically and welded to 16 gauge wires spaced 2 inches o.c. horizontally, with perforated Kraft paper to insure plaster embedment and Type I Class D waterproof building paper laminated to back side.

2.02 ACCESSORIES

A. Corner Bead: #1X Type, Keene or equal, expanded metal flanges integral with nose bead of solid metal, galvanized.
B. Corner Lath: As specified for expanded metal, three (3) inch legs bent to a 105-degree corner, - "Cornemaster #30" by Keene, or equal.
C. Casing Beads: #66 Type, Western, or equal, expanded metal flange, galvanized, depth as required by plaster thickness, weighing approximately 200# per 1000 lineal feet for 3/4-inch and 7/8-inch types.
D. Expansion Joints: #15 by Keene or equal. Cut lath passing under expansion joints. Install where indicated on Drawings, with the following minimum conditions:
    1. No length should be greater than 18 feet in either direction
    2. No panel shall exceed a maximum of 144 square-feet for vertical applications.
    3. No panel shall exceed a maximum of 100 square-feet for horizontal, curved or angular sections.
    4. No length-to-width ratio should exceed 2.5 to 1 in any given panel.
E. Bonding Agent: As recommended for application over smooth monolithic concrete shells. Concrete shells shall be cleaned with bonding agent applied prior to plastering interior.
F. Wire: Soft, annealed, galvanized steel, 8-gauge for hangers, 16-gauge for channel ties and 18-gauge for lath ties.
G. Nails: Concrete nails, case hardened steel, 3/4 inch long.
H. Weep Screed: by Keene or equal, 1-1/4" ground, galvanized.
I. Building Paper: 15#, asphalt impregnated. Install over Weather Barrier specified in Section 07 25 00 and shown on the Drawings.
J. Miscellaneous Items: Furnish all miscellaneous components not specified herein but shown on the Drawings and any other items required to complete the installation.
K. Water: Clean and free of deleterious matter.

2.03 PORTLAND CEMENT PLASTER

A. Portland Cement: Conforming to ASTM C-150, Type 1.
B. Sand for Cement Plaster: Conforming to ASTM C926.
C. Hydrated Lime: Conforming to ASTM C-206, Type S.
D. Quick Lime: Conforming to ASTM C-5.
E. Exterior Cement Plaster:
    1. Scratch Coat: One part Portland Cement, four (4) parts sand and hydrated lime equal to 25% volume of cement.
    2. Brown Coat: One part Portland Cement, five parts sand and hydrated lime equal to 25% of the volume of cement.
    3. Finish Coat: Portland Cement-Lime: one part standard Portland Cement, not more than 1/2 part dry hydrated lime (or an equivalent amount of lime putty) and not more

than one part #20 mesh, and one part #16 mesh silica sand. Submit finish sample(s) for Architect's approval.

4. Thickness: 7/8 inch thick, measured from back of lath.
5. Finish coat to contain integral color. Submit samples to Architect for approval based upon colors indicated on Drawings.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine the areas and condition under which work of this Section will be performed.
B. Verify that specified items may be installed in accordance with the approved design.
C. Correct conditions detrimental to timely and proper completion of the Work.
D. Do not proceed until unsatisfactory conditions are corrected.
E. Beginning of installation means acceptance of conditions.

3.02 GENERAL

A. Coordinate work with other trades as needed to assure that proper substrate are provided to receive work of this Section.
B. Provide ventilation to properly dry plaster during and subsequent to application. In glazed areas, accomplish by keeping windows open sufficiently to provide air circulation; in enclosed areas lacing normal ventilation, mechanically remove moisture-laden air.

3.03 LATHING

A. Apply lath with long dimension at right angles to supports; lap side and ends as recommended by manufacturer. Stagger vertical laps. Make no vertical joints at any corner; bend lath around all corners, internal and external.
B. Attach lath to studs by fasteners at spacings required by local building codes. All attachments to be corrosion resistant.
C. Install all accessories to plumb, true and level lines, and backing plates as located by the trade furnishing these items.
D. Install beads, corner laths, control joints, reglets, screeds, and like items, using single lengths wherever possible. Provide corner beads at all exterior corners shown, mitering or coping as required, and fastening at six (6) inches o.c., both sides. Provide casing beads wherever interior plaster angles are shown and wherever one or both abutting surfaces are metal lathed, except corner laths are not required where metal lath is continuous around corner at junctions of walls, or where ceiling lath turns down a wall. Tie outer edges only to adjoining lath at six (6) inches o.c. or stub nail to any concrete. Install access panels supplied by other trades.
E. Start installation at bottom of wall, working up and from right to left. Apply lath with long dimension at right angles to supports; lap sides and ends as recommended by manufacturer. Stagger vertical laps. Make no vertical joints at any corner; bend lath around all corners, internal and external.
F. Attach lath to metal and/or wood studs by means of tie wire and nails respectively at spacings as required by Local Building Codes. All attachments shall be corrosion resistant.
G. Install corner beads at all external corners. Use single length except where standard length is not sufficient. Miter or cope as required; fasten with tie wire at six (6) inches o.c., both sides.

H. Install at interior angles and sheer one or both abutting surfaces are metal lath. Corner laths are not required where metal lath is continued around corner at junction of walls and where ceiling lath turns down wall unless otherwise noted on drawings. The outer edges only to adjoining lath at six (6) inches o.c., or stub nail to concrete.

3.04 PLASTERING

A. Do not apply plaster below 55 degrees F temperature. Apply no plaster to frosty surfaces. Dampen any surfaces on which suction must be reduced with fog-spray. Maintain all screeds plumb and true.

B. Except when had mixing small batches is approved, use approved mechanical mixers. Clean mixers, mixing boxes and tools after mixing each batch. Thoroughly mix with water until uniform in color and consistency. Retempering not permitted. Discard plaster, which has begun to stiffen. Mix in strict accordance with manufacturer's printed directions.

C. Except in the case of specifically formulated plasters, which require only water added job site, proportion by volume as specified.

D. Scratch coat: Apply with sufficient material and pressure to shove material through metal lath and form a good key; 3/8 inch minimum thickness, score in horizontal direction with metal scorer with clipped teeth to provide good mechanical key for second coat. Dampen concrete and concrete block surfaces to reduce suction prior to application.

E. Brown coat: Apply not sooner than 48 hours after application of scratch coat; properly dampen scratch coat; apply sufficient pressure to force plaster into scratches and build out to within 1/8 inch to screeds; for, float and darby to true, plumb surfaces and corners; leave rough for finish coat.

F. Curing: Keep Brown coat moist for at least 48 hours; commence moistening as soon as plaster has hardened sufficiently so to prevent injury; apply water in a fine fog spray; avoid soaking; curing shall proceed over holidays, Saturdays and Sundays if necessary. If atmospheric conditions are hot and dry, curing time shall be extended as necessary at no additional cost to Owner. Allow plaster base coats to cure for a minimum of fourteen (14) days before applying finish coat.

G. Finish coats Apply to partially dry base coat, or to a thoroughly dry base coat that has been evenly wetted by brushing or spraying; avoid use of excessive water. Trowel all finish surfaces of plaster to perfectly true and even surface without scratches, ridges, voids, cracks, etc. Fill fissures or breaks in brown coat and existing plaster before application of finish coat. Make coats uniform in thickness with average thickness about 1/8 inch; minimum thickness anywhere: 1/16 inch.

3.05 CLEANING AND PATCHING

A. A clean floor of droppings immediately after each coat is applied. At any exterior locations, remove droppings or splashes from all concrete, masonry or other finish surfaces.

B. Patch after all other Work, except painting, has been completed. Cut out damaged or broken plaster to straight lines with clean, sharp edges. Cut out cracks to width of at least one (1) inch. Fill areas to be patched with base materials, and then give a finish coat of same material as adjoining plaster. Patched areas shall match adjoining work in finish and texture. Joining shall be flush and smooth so joints between patch and existing plaster are not noticeable.

C. At completion of Work, remove excess plaster from beads, screeds, etc., and leave Work clean and ready for painting. Promptly remove plaster, rubbish, surplus material, scaffolding and other equipment from job site. Leave areas broom clean.

END OF SECTION

SECTION 09 29 00

GYPSUM BOARD

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SCOPE OF WORK SUMMARY

Supply and install all Gypsum Board Products, as shown on Drawings and as specified herein, including all accessories and labor for a timely, complete, and proper installation

A. Fire-Resistance Rated Gypsum Board
B. Mold and Moisture Resistant Gypsum Board
C. Fire-Resistance, Mold and Moisture Resistant Gypsum Board
D. Abuse Resistant Gypsum Board
E. Impact Resistant Gypsum Board
F. Cement Board

1.03 STANDARDS AND REFERENCES

Comply with the Industry Standards and References as established by Manufacturer.

1.04 QUALITY ASSURANCE

A. Comply with the Standard requirements established by Manufacturer.

1.05 SUBSTITUTIONS

Substitutions will be considered per Section 01 25 00 Substitution Procedures.

1.06 SUBMITTALS

Provide in accordance with Section 01 33 00 Submittal Procedures.

1.07 DELIVERY, STORAGE, AND HANDLING

Comply with the requirements of Section 01 66 00 Product Storage and Handling Requirements.

1.08 PROJECT CONDITIONS

Comply with the requirements of Sections 01 50 00 Construction Facilities.

1.09 WARRANTY

Provide Standard Warranty in accordance with Section 01 78 36 Warranties.

PART 2 - PRODUCTS

2.01 MANUFACTURER / PRODUCTS

Basis of Design: Products of National Gypsum Company

2.02 FIRE-RESISTANCE RATED GYPSUM BOARD

A. Basis of Design: Gold Bond® BRAND Fire-Shield C Gypsum Board.
B. Panel Physical Characteristics:
    1. Core: Enhanced fire-resistance rated gypsum core

2. Surface paper: 100% recycled content paper on front, back and long edges
3. Long Edges: Square or Tapered at Contractor's discretion.
4. Overall thickness: 5/8 inch.
5. Panel complies with Type X requirements of ASTM C 1396 Standard Specification for Gypsum Board

2.03 MOLD AND MOISTURE RESISTANT GYPSUM BOARD

A. Basis of Design: Gold Bond® BRAND XP® Gypsum Board
B. Panel Physical Characteristics

1. Core: Mold and moisture resistant gypsum core.
2. Surface paper: 100% recycled content moisture/mold/mildew resistant paper on front, back, and long edges.
3. Long Edges: Square or Tapered at Contractor's discretion.
4. Overall thickness: 5/8 inch.
5. Panel complies with requirements of ASTM C 1396 Standard Specification for Gypsum Board.
6. Mold/Mildew Resistance: 10 when tested in accordance with ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber

2.04 FIRE-RESISTANCE RATED GYPSUM BOARD WITH ENHANCED MOLD AND MILDEW RESISTANCE

A. Basis of Design: Gold Bond® BRAND XP® Fire-Shield® C Gypsum Board
B. Type C, Panel Physical Characteristics

1. Core: Mold and moisture resistant, with enhanced fire-resistance rated gypsum core
2. Surface paper: 100% recycled content moisture/mold/mildew paper on front, back and long edges
3. Long Edges: Square or Tapered at Contractor's discretion.
4. Overall thickness: 5/8 inch.
5. Panel complies with requirements Type X of ASTM C 1396 Standard Specification for Gypsum Board
6. Mold/Mildew Resistance: 10 when tested in accordance with ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber

2.05 CEMENT BOARD

A. Cement Backerboard

1. Basis of Design: PermaBase® BRAND Cement Board
2. Panel Physical Characteristics

a. Core: Cementitious, water-durable
b. Surface: Fiberglass mesh on front and back
c. Long Edges: Tapered
d. Overall Thickness: 5/8 inch.

e. Panel complies with requirements of ASTM C 1325 Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units and ANSI A118.9
f. Density: 72 lbs. per cu. ft.
g. Water Absorption: Not greater than 8% when tested for 24 hours in accordance with ASTM C 473 Standard Test Methods for Physical Testing of Gypsum Panel Products

B. Cement Board Underlayment

1. Basis of Design: PermaBase® BRAND Cement Board
2. Panel Physical Characteristics

a. Core: Cementitious, water-durable
b. Surface: Fiberglass mesh on front and back
c. Long Edges: Tapered
d. Overall Thickness: 1/4 inch
e. Panel complies with requirements of ASTM C 1325 and ANSI A118.9
f. Density: 72 lbs per cu. ft.
g. Water Absorption: Not greater than 8% when tested for 24 hours in accordance with ASTM C 473 Standard Test Methods for Physical Testing of Gypsum Panel Products

2.06 ACCESSORY PRODUCTS

A. Acoustical sealant

1. Conform to ASTM C 919 Standard Practice for Use of Sealants in Acoustical Applications
2. Products/Manufacturer

a. Grabber Acoustical Sealant GSC
b. STI SpecSeal Smoke N Sound Caulk
c. BOSS 824 Acoustical Sound Sealant

B. Firestopping

1. Conform to ASTM E 90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
2. Products/Manufacturer

a. STI SpecSeal SSP Putty Pads
b. BOSS 818 Fire Rated Putty Pads

C. Fasteners for use with 5/8 inch thick tile backer panels: As recommended by Manufacturer.
D. Fasteners for use with Cement Board:

1. PermaBase Cement Board Hi-Lo thread screws (No. 8).
2. Wafer head, corrosion-resistant.
3. Overall Thickness: As recommended by Manufacturer.

4. For use with wood framing and complying with ASTM C 1002 Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

E. Joint Treatment

1. Tape - As recommended by Manufacturer:
    a. Paper Tape: 2-1/16 inches wide.
    b. Paper Tape: 2 inches wide with metal strips laminated along the center crease to form inside and outside corners.
    c. Fiberglass Tape: Nominal 2 inches wide self-adhering tape.
    d. Alkali-resistant Fiberglass Tape: Nominal 2 inches wide polymer coated alkali-resistant mesh tape.
2. Drying Type Compound - As recommended by Manufacturer:
    a. Ready Mix vinyl base compound.
    b. Ready Mix vinyl base compound formulated for enhanced mold and mildew resistance.
    c. Ready Mix vinyl base compound formulated to reduce airborne dust during sanding.
    d. Ready Mix vinyl base topping compound for finish coating.
    e. Ready Mix vinyl base compound for embedding joint tape, corner beads or other accessories.
    f. Field Mix vinyl base compound.
3. Setting Compound - As recommended by Manufacturer:
    a. Field mixed hardening compound.
    b. Field mixed hardening compound for fire resistance rated construction and penetrations.
4. Joint Sealant: Conform to ASTM C920 Standard Specification for Elastomeric Joint Sealants.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive gypsum products to verify conditions.
B. Report conditions contrary to contract requirements that would prevent a proper installation.
C. 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 conditions.
E. Installation indicates acceptance of the conditions with regard to conditions existing at the time of installation.

3.02 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840, GA-216 or GA-214.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panel not less than one framing member.
C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
E. Form control and expansion joints with space between edges of adjoining gypsum panels.
F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
    1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
    2. Fit gypsum panels around ducts, pipes, and conduits.
    3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4 to 3/8 inch (6 to 9 mm) wide joints to install sealant.
G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4 to ½ inch (6 to 12 mm) wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
H. Attachment to Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

3.03 INSTALLATION, INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
    1. Regular Type: Vertical or horizontal surfaces, unless otherwise indicated.
    2. Type X: Where required for fire-resistance-rated assembly.
    3. Type C: Where required for specific fire-resistance-rated assembly indicated.
    4. Ceiling Type: Ceiling surfaces.
    5. Moisture and Mold-Resistant Type: Areas with limited exposure to water.
    6. High Impact Type: As indicated on Drawings.
    7. Abuse Resistant Type: As indicated on Drawings.
B. Single-Layer Application:
    1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
    2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
        a. Stagger abutting end joints not less than one framing member in alternate courses of panels.

b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.

3. On furring members, apply gypsum panels vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:
1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

D. Laminating to Substrate: 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 written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.04 INSTALLATION, CEMENT BOARD PANELS

A. Install in accordance with manufacturer recommendation and ANSI A108.11.
B. Install where tile finish is indicated in the Drawings.
C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.05 INSTALLATION, TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
B. Control Joints: Install control joints at locations indicated on Drawings and if not shown according to ASTM C 840 or GA-216 and in specific locations approved by Architect for visual effect.
C. Interior Trim: Install in the following locations
1. Cornerbead: Use at outside corners, unless otherwise indicated. Install standard 90 degree cornerbeads where corner guards and chair rails are to be installed.
2. LC-Bead: Use at exposed panel edges.

3.06 FINISHING GYPSUM BOARD

Provide a Level 4 Finish, with a light orange-peel texture. All joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all flat joints and one separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. All joint compounds shall be smooth and free from tool marks and ridges. The prepared surface shall be coated with Sheet Rock Brand First Coat Primer, or equal, prior to the application of the light orange-peel texture.

3.07 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
    1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
    2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 09 30 00

TILING

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SCOPE OF WORK SUMMARY

Supply and install all materials and labor, as shown on Drawings and as specified herein, including all accessories and hardware for a timely, complete, and proper installation.

A. Porcelain and Ceramic Tile
B. Floor and Wall Glazed.
C. Wall Glazed.
D. Trim and Accessories.
E. Setting Materials.

1.03 STANDARDS AND REFERENCES

A. Comply with TCNA's "Handbook for Ceramic Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
B. Certificate of grade: Submit for approval, with each delivery, manufacturer's grade certificate in conformance with Tile Manufacturers Association, certifying grade, type and quality of tile furnished.
C. Dynamic Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ANSI 137.1.
D. Tile delivered in sealed cartons identified with grade certificate.
E. Cartons of tile kept dry until tiles are removed, tile prevent from staining.
F. All tile free from chips, cracks, scratches, pits or other defects.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products of this section with minimum ten years documented experience.
B. Installer Qualifications: Company specializing in performing the work of this section with minimum of five years' documented experience.
C. Single Source Responsibility: Obtain each type and color of tile from a single source. Obtain each type and color of mortar, adhesive and grout from the same source.
D. Performance Requirements: Dynamic Coefficient of Friction (DCOF): Provide floor tiles at interior level spaces with a wet dynamic coefficient of friction value of 0.42 or greater when tested in accordance with ANSI A137.1-2012 standard for ceramic tile.

1.05 SUBSTITUTIONS

Substitutions will be considered per Section 01 25 00 Substitution Procedures.

1.06 SUBMITTALS

A. Provide in accordance with Section 01 33 00 Submittal Procedures.
B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Manufacturer’s Specifications, catalog cuts, and other data needed to prove compliance with the specified requirements of tile, sealants, grout, trim, fasteners, adhesives and sealers.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Installation methods.

C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.
D. Selection Samples: Samples of actual tiles for selection.
E. Samples: Mount tile and apply grout on two plywood panels, illustrating pattern, color variations, and grout joint size variations.
F. Manufacturer's Certificate:

1. Certify that products meet or exceed specified requirements.
2. For each shipment, type and composition of tile provide a Master Grade Certificate signed by the manufacturer and the installer certifying that products meet or exceed the specified requirements of ANSI A137.1.

G. Results of compliance of Flooring Substrate for requirements of Moisture & PH Testing prior to installation in accordance with Section 07 05 00.
H. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
1. Locate mock-ups on site in locations and size directed by Architect. The mock-up may be part of the work and may be incorporated into the finish when so accepted by the architect.
2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
3. Refinish mock-up area as required to produce acceptable work.
4. Retain and maintain mock-ups during construction in undisturbed condition as a standard for judging completed unit of Work.
5. Obtain Architect's acceptance of mock-ups before start of final unit of Work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with the requirements of Section 01 66 00 Product Storage and Handling Requirements.
B. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements of ANSI A137.1 for labeling sealed tile packages.
C. Prevent damage or contamination to materials by water, freezing, foreign matter and other causes.
D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.08 PROJECT CONDITIONS

A. Comply with the requirements of Section 01 50 00 Construction Facilities.
B. 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.
C. Environmental: Install mortar, set and grout tile when surfaces and ambient temperature is minimum 50 degrees F (10 degrees C) and maximum 90 degrees F (32 degrees C). Consult with manufacturer for specific requirements.
D. Do not install mortar, set or grout tile exterior when inclement weather conditions are expected within 48 hours after work is completed unless properly protected.
E. Protection: Protect adjacent work surfaces during tile work. Close rooms or spaces to traffic of all types until mortar and grout have set.
F. Safety: Observe the manufacturer's safety instructions including those pertaining to ventilation.

1.09 OPERATION AND MAINTENANCE DATA

A. Provide in accordance with Section 01 77 00 Project Closeout.
B. Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.10 EXTRA MATERIALS

A. Provide in accordance with Section 01 77 00 Project Closeout.
B. Provide for Owner's use a minimum of 2 percent, but not less than one box, of the each of the sizes and colors of tile specified, boxed and clearly labeled.

1.11 WARRANTY

Provide Standard Warranty in accordance with Section 01 78 36 Warranties.

PART 2– PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
    1. Emser Stone and Tile, www.emser.com – Contact: Lori Fisher (Architectural Sales Representative) at (760) 834-2095, lorifisher@emser.com.
    2. Daltile, www.daltile.com – Contact: Christina Regan (Architectural Sales Representative) at (909) 844-7186, Christina.regan@daltile.com.
    3. Arizona Tile, www.arizonatile.com – Contact: Phil York (Architectural Sales Representative) at (760) 321-2005, pyork@arizonatile.com.
B. Tile: Standard grade, meeting the simplified Practice Recommendations F61-61, also Fed. Spec. SS-T-308B and ANSI A-137.1. Cartons grade sealed.

2.02 TILE

A. General: Provide tile that complies with ANSI A137.1 for types, compositions and other characteristics indicated. Provide tile in the locations and of the types colors and pattern indicated on the Drawings and identified in the Schedule and the end of this Section. Tile shall also be provided in accordance with the following:

    1. Factory Blending: For tile exhibiting color variations within the ranges selected under Submittal of samples, blend tile in the factory and package so tile taken from one package shows the same range of colors as those taken from other packages.

2. Mounting: For factory mounted tile, provide back or edge mounted tile assemblies as standard with the manufacturer, unless otherwise specified.
3. Factory Applied Temporary Protective Coatings: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by pre-coating with a continuous film of petroleum paraffin wax applied hot. Do not coat unexposed tile surfaces.

B. Material:

1. Furnish: size(s), color(s), pattern(s) and shape(s) as indicated on the drawings.
2. Trim Units: Matching bullnose, cove/inside finger cove, radius cap, sink rail, sink rail incorner/outcorner, cement bullnose, cove base, fabric bullnose, grooved bullnose, jolly shapes in sizes coordinated with field tile
3. Provide standard accessory shapes as required and as accepted by Architect.
4. Use appropriate trim shapes to conform to drawings.
5. Metal trims shall have a clear anodized finish – protected as to resist discoloration from adhesives and grouts.
6. Floor Tile: Shall meet the static coefficient of friction (COF) prescribed by ADAAG – 0.6 for level floors and 0.8 for ramps.

2.03 TRIM AND ACCESSORIES

Non-Ceramic Trim: Satin natural anodized extruded aluminum, stainless steel, brass, etc., style and dimensions to suit application, for setting using tile mortar or adhesive; use in the following locations:

A. Product: as indicated on the drawings.
B. Open edges of floor tile.
C. Transition between floor finishes of different heights.
D. Thresholds at door openings.
E. Expansion and control joints, floor and wall.

2.04 SETTING MATERIALS

A. Membranes: Liquid applied waterproof/crack isolation membrane (For Cracks Up To 1/8”):

1. Basis: Custom Building Products RedGard waterproof/crack isolation membrane.
2. Acceptable Products: Laticrete International Hydro Ban Floor and Wall Waterproofing & Crack Isolation & MAPEI Mapelastic AquaDefense.

B. Bonding Materials:

1. Bonded Mortar Bed Installations: Where indicated on the drawings, and elsewhere as required for mortar bed or brown coat as the substrate for tile work; work to conform to ANSI A108.1.
    a. Portland cement: ASTM C 150, Type 1.
    b. Sand: ASTM C 144.
    c. Water: Potable, fresh.
    d. Setting bed reinforcing mesh: 2-inch by 2-inch by 16/16, 3-inch by 3-inch by 13/13 or 1-1/2-inch by 2-inch by 16/13 wire complying with ASTM A 82 or A 185.

e. Latex modified dry-set mortar: The following or equal with physical properties equaling or exceeding those of the products specified.
f. Mortar Bed Bonding Mortar; Custom Building Products VersaBond mortar bed bonding mortar.

2. Medium Bed/Thin Set (Non Slumping) Mortar:
   a. Basis: Custom Building Products ProLite polymer modified thin set/medium bed mortar.
   b. Acceptable Products: Laticrete International 255 MultiMax or MAPEI Large Floor Tile Mortar

C. Grout:
   1. Portland cement grout at walls:
      a. Basis: Custom Building Products Polyblend Sanded Grout, ANSI A118.7 for joints 1/8 inch to 1/2 inch.
      b. Acceptable Products: Laticrete International PermaColor Grout or MAPEI Ultracolor Plus Grout
   2. Epoxy Grout at floors
      a. Basis: Custom Building Products CEG-Lite Epoxy Grout, ANSI A118.7 for joints 1/8 inch to 1/2 inch.
      b. Acceptable Products: Laticrete International PermaColor Grout or MAPEI Ultracolor Plus Grout.
D. Silicone Sealant: 100% Silicone Caulk by Custom Building Products or equal; color as indicated in drawings.
E. Tile and Grout Sealer: Aqua Mix, Inc., Santa Fe Springs, CA
F. Reinforcing – provide according to manufacturer requirements:
   1. Mesh: 2 by 2 inch (50 by 50 mm) size weave of 16/16 wire size; welded fabric, galvanized.
   2. Metal Lath: ÅSTM C847, Flat expanded diamond mesh, not less than 2.5 lbs/SY, galvanized finish.
G. Cementitious Backer Board: Refer to Section 09 29 00 for Cement Backer Board.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that wall surfaces are free of substances which would impair bonding of setting materials, smooth and flat within tolerances specified in ANSI A137.1, and are ready to receive tile.
B. Verify that sub-floor surfaces are dust-free, and free of substances which would impair bonding of setting materials to sub-floor surfaces, and are smooth and flat within tolerances specified in ANSI A137.1.
C. Verify that required floor-mounted utilities are in correct location.
D. According to Section 07 05 00, verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.
E. Report any 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 conditions. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.

3.02 PREPARATION

A. General
   1. Coordinate work with other trades as needed to assure that proper substrate are provided to receive work of this Section.
   2. Before tiling, confirm variations of surface to be tiled fall within maximum variations shown below:
      a. Cement Mortar Bed: ¼" in 8' for walls, ¼" in 10' for floors.
      b. Epoxy Adhesive: 1/8" in 8' for walls, 1/8" in 10' for floors.
      c. Organic Adhesive: 1/8" in 8' for walls, 1/8" in 8' for floors
   3. Surfaces shall be clean and free of dust, oil, grease, paint, tar, wax, curing compound, primer, sealer, form release agent, laitance, loosely bonded topping, loose particles or any deleterious substance and debris which may prevent or reduce adhesion.
   4. Patch any deep abrasions to the existing mortar bed substrate prior to skim coating and installing the new crack isolation membrane

B. Concrete Surface Preparation
   1. All concrete substrates shall be at least 28 days old, completely cured and free of hydrostatic conditions, and/or moisture problems.
   2. New concrete surfaces for dry-set mortar, medium-bed mortar or thick-bed mortar installations shall be wood floated or broom finished. Concrete walls should be bush-hammered or heavily sandblasted. On grade or below grade concrete slabs must be installed over an effective vapor barrier and be exempt from hydrostatic pressures.
   3. Over excessively dry porous concrete, keep the concrete substrate continuously moist for at least 24 hours before work begins when using dry-set mortars or medium-bed mortars. Remove all excess water or standing water allowing the surface to become almost dry before installing the leveling coat, dry-set mortar or medium-bed dry-set mortar.
   4. For minor repairs and smoothing up to 1/2 inch (12 mm), use Skim Coat & Patch Cement Underlayment or Speed Finish Patching & Finishing Compound.
   5. For leveling of large areas use LevelLite Self-Leveling Underlayment for pours up to 2 inches (51 mm) thick, LevelQuik Rapid Setting Self-Leveling Underlayment for pours up to 1 inch (25 mm) thick or Extended Setting Self-Leveling Underlayment for pours up to 1 inch (25 mm) thick.
   6. Custom Float Bedding Mortar mixed with water and Acrylic Mortar Admix to build-up or level a concrete substrate requiring a topping between 1/2 inch (12 mm) and 2 inch (50 mm) average thickness (see data sheet for details).

3.03 INSTALLATION – GENERAL

A. Comply with current TCNA's "Handbook for Ceramic Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series

"Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

B. Except as otherwise may be specified herein, all tile work shall conform with Standard Specifications A-108.1, A-108.4, A-108.5, A-108.6, A-108.9, A-108.10 issued by the American National Standards Institute.

C. All tile shall be cut for proper fitting around work in place. Exposed edges of cuts shall be rubbed smooth with an abrasive stone. All tile shall be ground and carefully fitted at intersections against trim finish between fixtures and accessories. Tile shall be carefully fitted around outlets, pipes, fixtures, and fittings so that the plates, escutcheons, or collars all overlap the cut.

D. Tile shall be kept free of stains before placing. Temporary guide strips shall be set with mortar or spot tiles shall be placed to fit the exact plans of each finish wall line. Mortar bed for interior glazed wall tile shall be not less than 3/8" thick and not more than 1/2" thick.

E. Pattern of tile shall be accurately laid out and established working from center of each wall or space to assure equal size tiles on ends. Patterns shall be as noted on the drawings.

F. All joints shall be grouted full, flush and smooth with the specified grout in accordance with the manufacturer's instructions.

G. All walls shall be checked for plumb and all angles checked for square before tile work is started.

3.04 LIQUID MEMBRANE INSTALLATION

A. Pre-treat Penetrations: Pack any gaps around pipes, lights or other penetrations with a compressible backer rod and suitable waterproof sealant. Apply a liberal coat of liquid around penetration opening. Embed pieces of 6" (15 cm) wide fabric into liquid. Cover with a second layer of liquid. After curing, seal flashing with a waterproof sealant.

B. Expansion Joints: Cracks in excess of 1/8" (3 mm) should be treated as expansion joints. Carry these types of joints through any subsequent finishing material. Clean the joint and install open or closed cell backer rod to the proper depth as outlined in EJ 171 in the Tile Council Handbook. Next, compress a sealant as specified by the architect into the joint, coating the sides and leaving it flush with the surface. After the sealant is dry, place bond breaker tape over joint. Apply a minimum 3/64" (1.2 mm) of liquid over the joint and substrate. Install the tile work onto the membrane but do not bridge the joint. After the tile work is set properly, fill the joint with any specified color sealant, following the architect’s and manufacturer’s instructions.

C. Pre-treat Drains:

1. Drains should have a clamping ring with open weep holes for thin-set application. Cut a square of reinforcing fabric approximately 38" x 38" (96 x 96 cm). In the center of the fabric cut a hole that matches the diameter of the drain throat. Apply a liberal coat of liquid to the bottom flange. Drain should be fully supported without movement and even with plane of substrate.
2. Center the circular cutout over the drain throat and embed the fabric into the liquid making sure it does not obstruct the drainage hole. Then apply an additional coat of liquid. Wet coat thickness should be 20 - 30 mils thick.
3. After curing, apply a waterproof sealant bead where the fabric cutout meets the drain throat. Clamp upper flange onto membrane and tighten. Caulk with a silicone caulk around flange where membrane and upper flange make contact. A toilet flange can be handled in much the same manner.

3.05 SETTING MATERIALS INSTALLATION

A. Specified medium bed setting materials may be installed up to 3/4 of an inch thick on horizontal surfaces.
B. Apply mortar or adhesive with notched trowel using scraping motion to work material into good contact with the wall surface to be covered. Maintain 95 percent coverage on back of Tile and fully bed all corners.
C. When installing natural stone Tiles, trowel a sufficient quantity of mortar adhesive onto back of each Tile.
D. Maintain 95 percent coverage on back of the Tile and fully bed all corners.
E. Apply only as much mortar or adhesive as can be covered within allowable windows as recommended by mortar or adhesive manufacturer or while surface is still tacky.
F. Set Tiles in place and rub or beat with small beating block.
G. Lightly beat or rap Tile to ensure proper bond and also to level surface of Tile.
H. The setting materials must be free of voids to create a continuous, solid bond.
I. Align Tile to show uniform joints and allow for setting until firm.
J. Clean excess mortar or adhesive from surface of Tile with wet cheesecloth while mortar is fresh.

3.06 GROUT INSTALLATION

A. Allow tile to set for a minimum of 48 hours prior to grouting. Remove all spacers, ropes, glue and foreign material prior to grouting.
B. Follow grout manufacturer's recommendations as to grouting procedures and precautions.
    1. Force maximum amount of grout into joints in accordance with pertinent recommendations in ANSI 108.10.
    2. Fill-joints of cushion edged tile to depth of cushion; fill square edged tile flush with surface.
    3. Provide hard finished grout which is smooth and without voids, pinholes or low spots.
    4. Seal grout with specified penetrating sealer 48-72 hours after grout application.

3.07 JOINT INSTALLATION

A. Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
B. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
C. Joints must be carried through all layers of installation materials including tile, setting bed, mortar bed and reinforcing wire. Joints should be every 20 to 25 feet in both directions for interior installations and 8 to 12 feet in both directions for exterior installations. (Refer to TCA Handbook, EJ171 and ANSI AN-3.8 for details on placements, size and specifications of materials).

3.08 INSTALLATION - FLOORS - MORTAR BED METHODS

A. Over interior concrete substrates, install in accordance with TCA Handbook Method F111, with cleavage membrane, unless otherwise indicated.
    1. Where waterproofing membrane is indicated, with standard grout or no mention of grout type, install in accordance with TCA Handbook Method F121.
    2. Where epoxy bond coat and grout are indicated, install in accordance with TCA Handbook Method F132, bonded.

3. Where epoxy or furan grout is indicated, but not epoxy or furan bond coat, install in accordance with TCA Handbook Method F114, with cleavage membrane.

B. Cleavage Membrane: Lap edges and ends.
C. Waterproofing Membrane: Install as specified in ANSI A108.13.
D. Mortar Bed Thickness: 1-1/4 to 2 inch (32 to 51 mm) maximum, unless otherwise indicated.

3.09 INSTALLATION – SHOWERS

A. At tiled shower receptors install in accordance with TCA Handbook Method B415, mortar bed floor, and W244, thin-set over cementitious backer unit walls.
B. Grout with standard grout as specified above.
C. Seal joints between tile work and other work with sealant specified in Section 07900.

3.10 INSTALLATION - WALL TILE

A. Over cementitious backer units on studs, install in accordance with TCA Handbook Method W244, using membrane at toilet rooms.
B. Over gypsum wallboard on wood or metal studs install in accordance with TCA Handbook Method W243, thin-set with dry-set or latex-portland cement bond coat, unless otherwise indicated.
C. Over wood studs without backer install in accordance with TCA Handbook Method W231, mortar bed, with membrane where indicated.
D. Over metal studs without backer install in accordance with TCA Handbook Method W241, mortar bed, with membrane where indicated.

3.11 CLEANING

Clean and seal all tile and grout surfaces.

3.12 PROTECTION OF FINISHED WORK

A. Do not permit traffic over finished floor surface for 72 hours after installation.
B. Cover floors with kraft paper and protect from dirt and residue from other trades.
C. Where floor will be exposed for prolonged periods cover with plywood or other similar type walkways

END OF SECTION

SECTION 09 51 00

ACOUSTICAL CEILINGS

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SCOPE OF WORK SUMMARY

Supply and install all Acoustical Ceiling Work, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation

1.03 STANDARDS AND REFERENCES

Comply with the Industry Standards and References as established by Manufacturer.

1.04 QUALITY ASSURANCE

A. Have applicators approved by manufacturer of material or system being installed.
B. Work hereunder requires coordination with trades whose Work connects with, is affected, or concealed by acoustical units. Before proceeding with Work, make certain all required inspections have been made.
C. Examine sub-surfaces to receive Work. Commencement of Work will be construed as acceptance of all sub-surfaces.
D. Comply with all applicable requirements of Acoustical Materials Association, Bulletin "Architectural Acoustical Materials".

1.05 SUBSTITUTIONS

Substitutions will be considered per Section 01 25 00 Substitution Procedures.

1.06 SUBMITTALS

A. Provide in accordance with Section 01 33 00 Submittal Procedures.
B. Submit complete layout of all systems including attachments, intersections of members and edge conditions.
C. Samples: submit 2 samples of each type of unit specified herein.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with the requirements of Section 01 66 00 Product Storage and Handling Requirements.
B. Deliver all manufactured materials in original containers bearing manufacturer's name and brand. Use only one brand for each type of unit throughout job. Store materials within building in locations directed.

1.08 PROJECT CONDITIONS

A. Comply with the requirements of Section 01 50 00 Construction Facilities.
B. Comply with Manufacturer’s Standard Requirements.

1.09 OPERATION AND MAINTENANCE DATA

Provide in accordance with Section 01 77 00 Project Closeout.

1.10 EXTRA MATERIALS
Comply with the requirements of Section 01 77 00 Project Closeout.

1.11 RECORD DRAWINGS
Provide in accordance with Section 01 77 00 Project Closeout.

1.12 WARRANTY
Provide Manufacturer's Standard Warranty in accordance with Section 01 78 36 Warranties.

PART 2 – PRODUCTS

2.01 SUSPENSION GRID

A. Ceiling Suspension Materials: Comply with ASTM C635, as applicable to the type of suspension system required for the type of ceiling units indicated. Coordinate with other work supported by or penetrating through the ceilings.
B. Manufacturer, Type, Location, and Pattern: as indicated on the drawings.
C. Edge Mouldings: Manufacturer's standard channel moulding for edges and penetrations of ceiling, with a single flange of moulding exposed, white baked enamel finish, unless otherwise indicated.

2.02 ACOUSTICAL TILE

A. Manufacturer, Type, Location, and Pattern: as indicated on the drawings.
B. Substitutions: As approved by Architect.

2.03 EXTRA STOCK

Order additional 3% of each type, with one box minimum, of acoustical unit specified, for maintenance use, at no additional cost to Owner.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Installer must examine the conditions under which the acoustical ceiling work is to be performed and notify the Contractor in writing of any unsatisfactory conditions. This installer shall make sure all unsatisfactory conditions have been corrected in a manner acceptable to the installer before proceeding with Work.
B. Provide all materials and accessories for complete installation per Drawings and manufacturer's printed instructions and recommendations.
C. Install units to sub-surfaces from setout points and to pattern shown on Drawings. Verify location of Work of other trades so their items occur within a whole unit or at joints as shown.
D. Install units in place fitting snugly. Provide spacers or hold-down clips where shown or required.
E. After installation, clean any soiled surfaces. Replace any damaged units at no additional cost to the Owner.
F. Arrange acoustical units in the manner shown by reflected ceiling plans. Consult with Architect pertaining to any adjustments.

3.02 SUPPORT SYSTEMS FOR SUSPENDED CEILING

A. General: Ceilings shall not support material or building components other than grills, insulation batts or light fixtures. Duct work, plumbing and like work shall have its own support system and shall not use the ceiling system or suspension wires.

B. Vertical Support System: Suspension wires shall be a minimum of 12-gauge galvanized wire attached to the main runner at 4 ft. maximum spacing in both directions. Each wire shall be anchored to the structure above with a device capable of supporting a minimum of 75 pounds. Wires supporting fixtures shall be capable of supporting four times the fixture weight. Suspension wires shall not hang more than 1 in 6 out of plumb unless counter sloping wires are provided. Wires shall not attach to or bond around interfering material such as ductwork. Trapeze or equivalent devices shall be used where obstructions interfere with direct suspension.

C. Horizontal Support System: The lateral support system for ceilings shall be shown in detail shop Drawings. Provisions shall be made for possible deferential movement between ceilings and sidewalls. Terminal ends of each main and each cross runner shall be wire supported; wall trim angles shall not provide primary support for runners. Lateral support of ceilings shall not be provided by the angle trim and runner shall not be riveted to wall trim.

D. Light Fixture Support: All recessed or drop-in light fixtures shall be supported directly from the fixture housing to the structure above with a minimum of two 12 gauge wires; leveling and positioning of fixture may be provided by the ceiling grid. Fixture support wires may be slightly loose to allow fixture to seat in heavy-duty grid system only.

E. Secure wire hangers by looping and wire tying either directly to structures or to inserts, eye-screws or other devices which are secure and appropriate for the substrate, and which will not deteriorate or fail with age or elevated temperatures.

3.03 CLEANING AND PROTECTION

A. Clean exposed surfaces of acoustical ceilings, including trim, edge mouldings and suspension members; comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

B. The installer shall advise the Contractor of required protection for the acoustical ceilings, including temperature and humidity limitations and dust control, so that the Work will be without damage and deterioration at the time of acceptance by the Owner.

END OF SECTION

SECTION 09 65 00

RESILIENT FLOOR AND BASE

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SCOPE OF WORK SUMMARY

A. Supply and install all Resilient Flooring and Base, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.
B. Work includes, but not limited to these major items:
    1. Resilient tile flooring.
    2. Floor substrate surface.
    3. Rubber base.

1.03 STANDARDS AND REFERENCES

Comply with the Industry Standards and References as established by Manufacturer.

1.04 QUALITY ASSURANCE

Conform to applicable code for flame rating requirements of 75 or less in accordance with ASTM E84.

1.05 SUBSTITUTIONS

Substitutions will be considered per Section 01 25 00 Substitution Procedures.

1.06 SUBMITTALS

A. Provide in accordance with Section 01 33 00 Submittal Procedures.
B. Provide product data on specified products, describing physical and performance characteristics.
C. Submit two samples, illustrating color and pattern for each floor material or base, substituted for those indicated in the Drawings.
D. Submit manufacturer's installation instructions. When approved by the Architect, will become the basis for accepting or rejecting actual installation procedure used on the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

Comply with the requirements of Section 01 66 00 Product Storage and Handling Requirements.

1.08 PROJECT CONDITIONS

A. Comply with the requirements of Section 01 50 00 Construction Facilities.
B. Store materials for three days prior to installation in area of installation to achieve temperature stability.
C. Maintain ambient temperature required by adhesive manufacturer three days prior to, during, and 24 hours after installation of materials.

1.09 OPERATION AND MAINTENANCE DATA

A. Provide in accordance with Section 01 77 00 Project Closeout.

B. Submit cleaning and maintenance data maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.10 EXTRA MATERIALS
A. Provide in accordance with Section 01 77 00 Project Closeout.
B. Provide 5% of each pattern and color of flooring and of base specified.

1.11 WARRANTY
A. Provide Warranty in accordance with Section 01 78 36 Warranties.
B. Duration: Manufacturer's 10-Year Commercial Limited Warranty.

PART 2 – PRODUCTS

2.01 RESILIENT SHEET – Refer to specification 09 65 16 Sheet Vinyl Flooring
Manufacturer(s), Type(s), Location(s), Color(s), and Pattern(s) as indicated on drawings.

2.02 RESILIENT PLANK/TILE
Manufacturer(s), Type(s), Location(s), Color(s), and Pattern(s) as indicated on drawings.

2.03 BASE MATERIALS
Manufacturer(s), Type(s), Location(s), Color(s), and Pattern(s) as indicated on drawings.

2.04 FLOORING TRANSITIONS
Manufacturer(s), Type(s), Location(s), Color(s), and Pattern(s) as indicated on drawings.

2.05 OTHER ACCESSORIES
A. Subfloor Filler: Latex cement underlayment as recommended by flooring material manufacturer.
B. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.
C. Sealer and Wax: Types recommended by flooring manufacturer.
D. Provide other materials, not specifically described but required for a complete and proper installation as selected by the Contractor subject to the approval of the Architect.

PART 3 – EXECUTION

3.01 EXAMINATION
A. Examine the areas and conditions under which work of this Section will be performed.
B. Verify that surfaces are smooth and flat with maximum variation of 1/8 inch in 10 ft. and are ready to receive work.
C. According to Section 07 05 00, verify that concrete floors are dry to the maximum moisture content of 2.5% (two and one half percent); and exhibit negative alkalinity, carbonization, or dusting. Higher moisture content will be as accepted by manufacturer in their written warranty.
D. Correct conditions detrimental to timely and proper completion of the Work.
E. Do not proceed until unsatisfactory conditions are corrected.
F. Beginning of installation means acceptance of conditions.

3.02 PREPARATION

A. Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with sub-floor filler.
B. Apply, trowel, and float filler to leave smooth, flat, hard surface.
C. Prohibit traffic from area until filler is cured.
D. Vacuum clean substrate.
E. Maintain the temperature of the space to receive the flooring and the materials to be installed at a minimum of 65 degrees F and maximum of 100 degrees F for at least 48 hours prior to, during, and 48 hours after installation. Maintain a minimum temperature of 55 degrees F thereafter.
F. Install flooring after all other trades, including painting, have been completed.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, conventional full-spread system.
B. Spread only enough adhesive to permit installation of materials before initial set.
C. Set flooring in place; press with heavy roller to attain full adhesion.
D. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar.
E. Install edge strips at unprotected or exposed edges, and where flooring terminates.
F. Scribe flooring to walls, columns, permanent cabinets, floor outlets, and other appurtenances to produce tight joints.

3.04 INSTALLATION -- BASE MATERIAL

A. Fit joints tight and vertical. Maintain minimum measurement of 18 inches between joints.
B. Miter internal corners. At external corners, "V" cut back of base strip to 2/3 of thickness and fold.
C. Install base on solid backing. Bond tight to wall and floor surfaces.
D. Scribe and fit to doorframes and other interruptions.

3.05 PROTECTION

Prohibit traffic on floor finish for 48 hours after installation.

3.06 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.
B. Clean, seal, and wax floor and base surfaces in accordance with manufacturer's instructions.

END OF SECTION

SECTION 09 65 16

SHEET VINYL 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 Contract (including General and Supplementary Conditions and Division 1 sections) 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.
B. Division 3 Concrete; not the work of this section.
C. Division 6 Wood and Plastics; not the work of this section.
D. Division 7 Thermal and Moisture Protection; not the work of this section.

1.04 QUALITY ASSURANCE AND REGULATORY REQUIREMENTS

A. Select an installer who is competent in the installation of resilient sheet flooring using heat welded seams.

B. Provide type of flooring, adhesives, and accessories supplied by one manufacturer.
C. If required, provide flooring material to meet local fire test performance criteria as tested by a recognized independent testing laboratory.

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, welding rods, and applicable accessories.
C. Submit a copy of the manufacturer's recommended maintenance procedures.
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.

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) in areas where work is completed. Protect all materials from the direct flow of heat from hot-air registers, radiators, or other heating fixtures and 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 - Provide Mannington Mills, Inc. resilient vinyl sheet flooring BioSpec MD in [color selected from the range currently available]

A. Product Specifications:
   i. Construction - Homogeneous Sheet, Non-ortho phthalate construction
   ii. Classification - ASTM F1913 Sheet Vinyl Floor Covering without Backing
   iii. Total Thickness - 0.080” (2.03 mm)
   iv. Wear Layer - Quantum Guard Elite® for no-wax, no-polish maintenance
   v. Width - 6’6” (2 m)
   vi. Colors - 70
   vii. Pattern Repeat - Random repeat, reverse sheet for seaming

B. Environmental:
   i. Indoor Air Quality - FloorScore Certified; CDPH v1.1-2010
   ii. Product Declarations - EPD
   iii. LEED Scoreboard - May contribute to LEED credits: LEED 2009: MRc5 Regional Materials; IEQ4.1 Low Emitting Adhesives; IEQ4.3 Low Emitting Materials - Flooring LEED v4: Building Product Disclosure & Optimization - EPDs; IEQc2 - Low Emitting Materials
   iv. Product must be listed on mindful MATERIALS mindfulmaterials.origin.build with current transparency information
   v. Recycled Content – 5% post-consumer recycled content
   vi. Manufacturing - Salem, NJ (USA) - ISO 14001 EMS & ISO 9001 QMS Registered

C. Testing:
   i. HUD/FHA - Meets / Exceeds ADAG (American Disability Act Guidelines)
   ii. Flexibility (ASTM F137) - Passes - 1 1/2” Mandrel - No Crack/Break
   iii. Static Load (ASTM F970) - Passes - Residual Indent ≤ 0.005”
   iv. Static Load (ASTM F970 mod.) - Passes - 2,000 PSI; Residual Indent ≤ 0.005”
   v. Rolling Resistance/Caster Chair (ISO 4918) - 25,000 Cycles, No Significant Change
   vi. Short Term Residual Indentation (ASTM F1914/F1303) - Passes - Must be < 0.007”
   vii. Flooring Radiant Panel (ASTM E648) - Passes - Class 1; ≥ 0.45 watts/cm2
   viii. Smoke Density (ASTM E662) - Passes - ≤ 450
   ix. Slip Resistance (ASTM C1028, Dry) - Passes - ≥ 0.5 Leather; 0.6 Rubber
   x. Acoustic IIC (ASTM E492) - 50 - 6” Concrete with Drop Ceiling

xi. Acoustic STC (ASTM E90) - 63 - 6” Concrete with Drop Ceiling
xii. Resistance to Light (ASTM F1515) - Passes - < 8 Delta E Color Change
xiii. Chemical Resistance (ASTM F925) - Passes - No More Than Slight Change
xiv. Resistance to Heat (ASTM F1514) - Passes - < 8 Delta E Color Change
xv. Resistance to Mold/Mildew (ASTM G2 1/E2180) - Passes - No More Than Slight Change

D. Warranty: Limited 12 Year Commercial Warranty & Quantum Guard Elite® Wear Warranty

2.02 WALL BASE MATERIALS

A. Basis of Design Manufacturer: Mannington Commercial. Contact: Don Hampton, Phone: 909-921-5521, Email : don.hampton@mannington.com
B. For integral flash cove base: Provide integral flash cove wall base by extending sheet flooring [4 in. (10.16 cm)] [6 in. (15.24 cm)] up the wall using adhesive, welding rod, and accessories recommended and approved by the flooring manufacturer.

2.03 ADHESIVES

A. Provide Mannington [V-82 Acrylic Flooring Adhesive] [V-95 Two Component Polyurethane Adhesive] [V-88 High Moisture Flooring Adhesive] [XpressStep Spray Adhesive] [QuickStix Pre-Applied Adhesive] [MoistureLoc Adhesive] under the flooring.
B. Provide [Solid Color Vinyl Weld Rod] as produced by the manufacturer of the resilient flooring and intended for welding of seams. [Weld rod 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.]
C. Use Mannington Quantum Guard Seam Coater pen on all seams to extend finish coat protection to seamed areas.
D. Provide MT-800 Seam Sealer, if needed, to chemically weld product to surrounding Integra HP broadloom carpet materials.

2.04 ACCESSORIES

A. Resilient sheet goods must have the ability to be chemically welded to adjoining broadloom carpet materials.
B. For patching, smoothing, and leveling monolithic subfloors (concrete, terrazzo, quarry tile, ceramic tile, and certain metals), provide Portland cement-based latex underlayment or patch and skim coat as recommended by the resilient flooring manufacturer.
C. 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.
D. [Provide top edge trim caps of [plastic] [anodized aluminum] [plastic zero reducer] for integral flash cove as approved by the Architect.
E. [Provide a fillet support strip for integral cove base with a minimum radius of 1 in. (2.54 cm) of wood or plastic.]
F. Provide transition / reducing strips tapered to meet abutting materials.
G. Provide threshold of thickness and width as shown on the drawings.
H. Provide resilient edge strips of width shown on the drawings, of equal gauge to the flooring, homogeneous vinyl or rubber composition, tapered or bullnose edge, with color to match or contrast with the flooring, or as selected by the Architect from standard colors available.
I. Provide metal edge strips of width shown on the drawings and of required thickness to

protect exposed edges of the flooring. Provide units of maximum available length to minimize the number of joints. Use butt-type edge strips for concealed anchorage or overlap-type edge strips for exposed anchorage.

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 latex underlayment or patch and skim coat as recommended by the flooring manufacturer.
B. Remove paint, varnish, oils, release agents, sealers, and waxes. Remove residual adhesives by mechanical means. Remove curing and hardening compounds by mechanical means. Avoid organic solvents.
C. Perform subfloor Relative Humidity and/or Calcium Chloride Tests (and Bond Tests) as described in "Mannington's Professional Installation Guide" and product specific installation instructions to determine if surfaces are dry; free of curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring as specified.
D. 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 the manufacturer's written 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. 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 to permanent fixtures, columns, walls, partitions, pipes, outlets, and built-in furniture and cabinets.
E. Chemical welding carpet to sheet vinyl: Mannington's seam sealer MT-800 must be used to chemically weld Integra HP Backing to commercial sheet vinyl per manufacturer's instructions.
F. 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.

3.04 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 as long as 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 [butt-type] [overlap] edge strips where shown on the drawings, [before] [after] flooring installation. 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.

B. 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 90 00

PAINTING

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SCOPE OF WORK SUMMARY

A. Supply and install all Painting, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.

B. Section Includes: Painting and finishing of all interior and exterior items and surfaces, unless otherwise indicated or listed under exclusions below:

1. Paint all exposed surfaces, except as otherwise indicated, whether or not colors are designated.
2. Include field painting of exposed exterior and interior structural steel, plumbing, mechanical and electrical work, except as indicated below.
3. Paint exterior plaster where indicated on Drawings.

C. Work Included:

The intent and requirements of this section is that all work, items and surfaces which are normally painted and finished in a building of this type and quality, shall be so included in this contract, whether or not said work, item or surface is specifically called out and included in the schedules and notes on the drawings, or is, or is not, specifically mentioned in these specifications.

D. The following general categories of work and items that are included under other sections, shall not be a part of this section:

1. Shop prime painting of structural and miscellaneous iron or steel.
2. Shop prime painting of hollow metal work.
3. Shop finished work and items.
4. Any drywall or plaster permanently concealed from view.
5. Any factory finished equipment and other materials with a complete factory applied finish.
6. Finish hardware except where primed for paint finish.
7. Any glass, plastics, floor tiles and sheet vinyl coved or vinyl top set bases.
8. Plumbing fixtures: Toilet room accessories.
9. Lighting fixtures except as noted on drawings or specified.
10. Any acoustical surfaces; unless otherwise specified.

E. The Room Finish Schedules indicated on the drawings, indicates the location of interior room surfaces to be painted or finished. The schedule indications are general and do not necessarily define the detail requirements. Include all detailed refinements and further instructions as may be given for the required complete finishing of all spaces and rooms.

1.03 STANDARDS AND REFERENCES

A. Regulatory Requirements: Comply with applicable codes and regulations of governmental agencies having jurisdiction including those having jurisdiction over airborne emissions and industrial waste disposal. Where those requirements conflict with this Specification, comply with the more stringent provisions.
B. Regulatory changes may affect the formulation, availability, or use of specified coatings. Confirm availability of coatings to be used prior to job going out to bid and before start of painting project.
C. Comply with the current applicable regulations of the California Air Resources Board (CARB) and the South Coast Air Quality Management District (SCAQMD). Field Sample: When and as directed by the Architect, apply one complete coating system for each color, gloss and texture required. When approved, the sample panel areas will be deemed incorporated into the Work and will serve as the standards by which the subsequent Work of this Section will be judged.

1.04 QUALITY ASSURANCE

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.05 SUBSTITUTIONS

Substitutions will be considered per Section 01 25 00 Substitution Procedures.

1.06 SUBMITTALS

A. Provide in accordance with Section 01 33 00 Submittal Procedures.
B. Materials List: Submit complete lists of materials proposed for use, giving the manufacturer's name, catalog number, and catalog cut for each item when applicable. When required, provide a list of paint and coating materials proposed for use, which equates such materials with the design-basis products specified.
C. Samples: Submit, on 8-1/2 inch by 11 inch hardboard, samples of each color, gloss, texture and material selected by the Architect from standard colors available for the coatings required. For natural and stained finishes, provide sample on each type and quality of wood used on the project.
D. Manufacturer's Instructions: Submit the manufacturer's current recommended methods of installation, including relevant limitations, safety and environmental cautions, application rates, and composition analysis.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with the requirements of Section 01 66 00 Product Storage and Handling Requirements.
B. Storage and Protection: Use all means necessary to protect the materials of this Section before, during, and after installation.
C. Deliver materials to job site in new, original, and unopened containers bearing manufacturer's name and trade name. Store where directed in accordance with manufacturer's instructions.

1.08 PROJECT CONDITIONS

A. Comply with the requirements of Section 01 50 00 Construction Facilities.
B. Do not apply exterior materials during fog, rain or mist, or when inclement weather is expected within the dry time specified by the manufacturer. No exterior or interior painting shall be done until the surfaces are thoroughly dry and cured. Do not apply paint when temperature is below 50° F. Avoid painting surfaces when exposed to direct sunlight.

1.09 OPERATION AND MAINTENANCE DATA

A. Provide in accordance with Section 01 77 00 Project Closeout.
B. Coating Maintenance Manual: Provide a S-W Custodian or similar coating maintenance manual including area summary with finish schedule, area detail designating location where each product/color/finish was used, product data pages, material safety data sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.10 EXTRA MATERIALS

A. Provide in accordance with Section 01 77 00 Project Closeout.
B. Provide 5% with a minimum of one gallon of each color and product used.

1.11 WARRANTY

Provide Manufacturer's Standard Warranty in accordance with Section 01 78 36 Warranties.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Sherwin-Williams. Architectural representative: Rocky Berlangal; Phone (657)269-0922 or Email rocky.m.berlanga@sherwin.com.
B. Acceptable Manufacturers: Dunn Edwards, Vista Paint or Architect approved equal.

2.02 MATERIALS

A. Paints: Provide Ready-Mixed, except field catalyzed coatings. Pigments shall be fully ground maintaining soft paste consistency, capable of being readily and uniformly dispersed to complete homogeneous mixture. Paints shall have good flowing and brushing properties and be capable of drying or curing free of streaks and sags.

B. Accessory Materials: Linseed oil, shellac, solvents, and other materials not specified but required to achieve required finishes shall be of high quality and approved by manufacturer.
C. Colors shall be selected from color chip samples provided by manufacturer of paint system approved for use. Match approved samples for color, texture and coverage.

2.03 MIXES

Mix, prepare, and store painting and finishing materials in accordance with manufacturer's directions.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which work of this Section will be performed.
B. Examine surfaces to be painted before beginning painting work. Work of other trades that has been left or installed in a condition not suitable to receive paint, stain, other specified finish shall be repaired or corrected by the applicable trade before painting. Painting of defective or unsuitable surface implies acceptance of the surfaces.
C. Do not proceed with surface preparation or coating application until conditions are suitable. Special attention should be made to all smooth and especially Level 5 Drywall Finish areas. In those instances, a test patch to ensure proper surface adhesion should be undertaken.
D. Beware of a condition known as "critical lighting". This condition causes shadows that accentuate even the slightest surface variations. A pigmented sealer will provide tooth for succeeding decorative coating, but "does not" equalize smoothness or surface texture. Any

corrective action to gypsum board/drywall must be done by the drywall contractor prior to decorating.

E. Notify the Construction Manager and Architect in writing of any conditions detrimental to the proper and timely completion of the installation.
F. Correct conditions detrimental to timely and proper completion of the Work.
G. Do not proceed until unsatisfactory conditions are corrected.
H. Beginning of installation means acceptance of conditions.

3.02 PROTECTION

A. Protect previously installed work and materials, which may be affected by Work of this Section.
    1. Protect prefinished surfaces, lawns, shrubbery and adjacent surfaces against paint and damage.
    2. Furnish sufficient drop cloths, shields, and protective equipment to prevent spray or splatter from fouling surfaces not being painted.
    3. Protect surfaces, equipment, and fixtures from damage resulting from use of fixed, movable and hanging scaffolding, planking, and staging.
B. Provide WET PAINT signs, barricades, and other devices required to protect newly finished surfaces. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.

3.03 PREPARATION

A. Perform preparation and cleaning procedures in strict accordance with coating manufacturer's instructions for each substrate condition.
B. Concrete and masonry surfaces shall be dry, clean, and free of dirt, efflorescence, encrustation, and other foreign matter. Glazed surfaces on concrete shall be roughened or etched to uniform texture.
C. Ferrous metal shall be cleaned per SSPC-SP1. All welds, loosely adhered rust, and debris must be power tool cleaned per SSPC-SP3. Prime within 3 hours after preparation.
D. Clean per SSPC-SP1 to remove greases and oils. Apply a test area, priming as required. Allow the coating to dry at least one week before testing. If adhesion is poor, power tool clean per SSPC-SP3 to remove these treatments.
E. Remove dust, grit and foreign matter from wood surfaces. Sand surfaces and dust clean. Spot coat knots, pitch streaks, and sappy section with pigmented stain sealer when surfaces are to be painted. Fill nail holes, cracks and other defects after priming and spot prime repairs when fully cured.
F. Remove hardware and accessories, machined surfaces, plates, lighting fixtures and similar items in place and not-to-be-finish painted, or provide surface-applied protection. Reinstall removed items upon completion of work in each area.
G. Existing surfaces to be recoated shall be thoroughly cleaned and de-glossed by sanding or other means prior to painting. Patched and bare areas shall be spot primed with same primer as specified for new work.
H. Thoroughly backpaint all surfaces of exterior and interior finish lumber and millwork, including doors and window frames, trim, cabinetwork, etc., which will be concealed after installation. Backpaint items to be painted or enameled with the priming coat. Use a clear sealer for backpriming where transparent finish is required.

I. Bar and covered pipes, ducts, hangers, exposed steel and ironwork, and primed metal surfaces of equipment installed under mechanical and electrical work shall be cleaned prior to priming.
J. Preparation of other surfaces shall be performed following specific recommendations of the coatings manufacturer.
K. Bond breakers and curing agents must be removed and the surface cleaned before primers, sealers or finish paints can be applied.
L. All drywall surfaces must be completely dry and dust free before painting. Skim coated drywall must be sealed with an alkyd based sealer or a waterborne sealer recommended by the paint manufacturer for this surface. Use the appropriate light or medium tack masking tape.
M. Do not apply initial coating until moisture content of surface is within limitations recommended by the paint manufacturer.
N. Do not paint over Underwriters's labels, fusible links or sprinkler heads.

3.04 APPLICATION

A. Apply painting and finishing materials in accordance with the manufacturer's submittals, as approved. Use applicators and techniques best suited for the material and surfaces to which applied.

1. The number of coats specified is the minimum that shall be applied. Apply additional coats when undercoats, stains or other conditions show through final paint coat, until paint film is of uniform finish, color and appearance.
2. All undercoats shall be tinted slightly to approximate the color of the finish coat.

B. Apply each material at not less than the manufacturer's recommended spreading rate: Provide a total dry film thickness of not less than 1.2 mils for each required coat.
C. Apply prime coat to surface, which is required to be painted or finished.
D. Finish exterior doors on tops, bottoms, and edges same as exterior faces, after fitting.
E. Sand lightly and dust clean between succeeding coats.

3.05 CLEANING, TOUCH-UP AND REFINISHING

A. Carefully remove all spattering, spots and blemishes caused by work under this section from surfaces throughout the project.

B. Upon completion of painting work remove all rubbish, paint cans, and accumulated materials resulting from work in each space or room. All areas shall be left in a clean, orderly condition.
C. Runs, sags, misses, holidays, stains and other defects in the painted surfaces, including inadequate coverage and mil thickness shall be satisfactorily touched up, or refinished, or repainted as necessary.

3.06 FINISH SCHEDULE

A. Apply the following finishes to the surfaces specified and/or as on the finish schedule on the Drawings. Apply all materials in accordance with manufacturer's instructions on properly prepared surfaces and foundation coats. All intermediate undercoats must be tinted to approximate the final color.

Architect will issue a color schedule prior to start of painting to designate the various colors and locations required for the work.

B. Exterior Systems:

1. Stucco & Plaster
   a. Flat – 100% Acrylic

First Coat	Loxon Primer LX2W50
Second Coat	A-100 Exterior Latex Flat A6 Series
Third Coat	A-100 Exterior Latex Flat A6 Series

   b. Semi-transparent Stain

First Coat	Loxon Vertical Semi-transparent Stain LX31T75
Second Coat	Loxon Vertical Semi-transparent Stain LX31T75
Third Coat	Loxon Vertical Semi-transparent Stain LX31T75

2. Concrete Block
   a. Flat – 100% Acrylic

First Coat	PrepRite Block Filler B25W25
Second Coat	A-100 Exterior Latex Flat A6 Series
Third Coat	A-100 Exterior Latex Flat A6 Series

   b. Satin – 100% Acrylic

First Coat	PrepRite Block Filler B25W25
Second Coat	A-100 Exterior Latex Satin A82 Series
Third Coat	A-100 Exterior Latex Satin A82 Series

   c. Gloss – 100% Acrylic

First Coat	PrepRite Block Filler B25W25
Second Coat	A-100 Exterior Latex Gloss A8 Series
Third Coat	A-100 Exterior Latex Gloss A8 Series

   d. High Gloss, High Performance – Acrylic/Urethane

First Coat	Heavy Duty Block Filler B42W46
Second Coat	Macropoxy 646-100 B58Series
Third Coat	Acrolon 100 WB Polyurethane B65 Series (Coat to Cover)

   e. Semi-transparent Stain

First Coat	Loxon Vertical Semi-transparent Stain LX31T75
Second Coat	Loxon Vertical Semi-transparent Stain LX31T75
Third Coat	Loxon Vertical Semi-transparent Stain LX31T75

5. Ferrous Metal
   a. Flat – Acrylic

First Coat	ProCryl Universal Acrylic Metal Primer B66-310
Second Coat	A-100 Exterior Latex Flat A6 Series
Third Coat	A-100 Exterior Latex Flat A6 Series

   b. Semi-Gloss – Acrylic

First Coat	ProCryl Universal Acrylic Metal Primer B66-310
Second Coat	Solo Acrylic Latex Semigloss A76 Series
Third Coat	Solo Acrylic Latex Semigloss A76 Series

   c. Gloss – Acrylic

First Coat	ProCryl Universal Acrylic Metal Primer B66-310
Second Coat	Solo Acrylic Latex Gloss A77 Series
Third Coat	Solo Acrylic Latex Gloss A77 Series

   d. Gloss – Rust Preventative Acrylic

First Coat	ProCryl Universal Acrylic Metal Primer B66-310

Second Coat ProIndustrial Acrylic Gloss B66-600 Series
Third Coat ProIndustrial Acrylic Gloss B66-600 Series

e. Gloss, Industrial High Performance – Inorganic Zinc/Epoxy/Acrylic
First Coat ZincClad III HS-100 B69 Series
Second Coat Macropoxy 646-100 B58 Series
Third Coat ProIndustrial Acrylic Gloss B66-600 Series(Coat to Cover)

f. Low Sheen, Industrial High Performance – Epoxy Primer/Epoxy/Acrylic (VOC compliant in SCAQMD)
First Coat Macropoxy 646-100 B58 Series
Second Coat Macropoxy 646-100 B58 Series
Third Coat ProIndustrial Acrylic Eg-shel B66-660 Series (Coat to cover)

g. High Gloss, Industrial High Performance – Inorganic Zinc/Epoxy/Urethane (VOC compliant in SCAQMD)
First Coat ZincClad III HS-100 B69 Series
Second Coat Macropoxy 646-100 B58 Series
Third Coat Acrolon 100 WB Polyurethane B65 Series(Coat to Cover)

h. High Gloss, Industrial High Performance – Epoxy Primer/Epoxy/Urethane (VOC compliant in SCAQMD)
First Coat Macropoxy 646-100 B58 Series
Second Coat Acrolon 100 WB Polyurethane B65 Series
Third Coat Acrolon 100 WB Polyurethane B65 Series

6. Galvanized Metal
a. Flat – Acrylic
Pretreatment GLL Clean n Etch
First Coat ProCryl Universal Acrylic Metal Primer B66-310
Second Coat A-100 Exterior Latex Flat A6 Series
Third Coat A-100 Exterior Latex Flat A6 Series

b. Semi-Gloss – Acrylic
Pretreatment GLL Clean n Etch
First Coat ProCryl Universal Acrylic Metal Primer B66-310
Second Coat Solo Acrylic Latex Semigloss A76 Series
Third Coat Solo Acrylic Latex Semigloss A76 Series

c. Gloss – Acrylic
Pretreatment GLL Clean n Etch
First Coat ProCryl Universal Acrylic Metal Primer B66-310
Second Coat Solo Acrylic Latex Gloss A77 Series
Third Coat Solo Acrylic Latex Gloss A77 Series

d. Gloss – Rust Preventative Acrylic
First Coat ProCryl Universal Acrylic Metal Primer B66-310
Second Coat ProIndustrial Acrylic Gloss B66-600 Series
Third Coat ProIndustrial Acrylic Gloss B66-600 Series

e. Low Sheen, Industrial High Performance – Epoxy Primer/Acrylic (VOC compliant in SCAQMD)
First Coat Macropoxy 646-100 B58 Series
Second Coat ProIndustrial Acrylic Eg-shel B66-660

Third Coat ProIndustrial Acrylic Eg-shel B66-660

f. High Gloss, Industrial High Performance – Epoxy Primer/Urethane
First Coat Macropoxy 646-100 B58 Series
Second Coat Acrolon 100 WB Polyurethane B65 Series
Third Coat Acrolon 100 WB Polyurethane B65 Series

7. Wood – Paint Finish
a. Semi-Gloss – Acrylic
First Coat PrepRite ProBlock Primer B51W8020
Second Coat Solo Acrylic Latex Semigloss A76 Series
Third Coat Solo Acrylic Latex Semigloss A76 Series

b. Gloss – Acrylic
First Coat PrepRite ProBlock Primer B51W8020
Second Coat Solo Acrylic Latex Gloss A77 Series
Third Coat Solo Acrylic Latex Gloss A77 Series

8. Wood – Stain Finish – Opaque:
Two Coats WoodScapes Water-based Solid Stain A15

9. Wood – Stain Finish – Semi-Transparent:
Two Coats WoodScapes Ext Semi-transparent Stain A15T

C. Interior Systems:
1. Gypsum Board
a. Flat – Acrylic
First Coat PVA Primer B28W8000
Second Coat ProMar 200 Zero VOC Flat B30-2600
Third Coat ProMar 200 Zero VOC Flat B30-2600

b. Low Sheen – Acrylic
First Coat PVA Primer B28W8000
Second Coat ProMar 200 Zero VOC Low Sheen B24-2600
Third Coat ProMar 200 Zero VOC Low Sheen B24-2600

c. Eggshell – Acrylic
First Coat PVA Primer B28W8000
Second Coat ProMar 200 Zero VOC Eg-shel B20-2600
Third Coat ProMar 200 Zero VOC Eg-shel B20-2600
d. Semi-Gloss - Acrylic
First Coat PVA Primer B28W8000
Second Coat ProMar 200 Zero VOC Semigloss B31-2600
Third Coat ProMar 200 Zero VOC Semigloss B31-2600

e. Gloss – Acrylic
First Coat PVA Primer B28W8000
Second Coat ProMar 200 Zero VOC Gloss B21-12650
Third Coat ProMar 200 Zero VOC Gloss B21-12650

f. Gloss– Industrial High Performance – Waterborne Epoxy
First Coat ProMar 200 Zero VOC Primer B28W2600
Second Coat WB Catalyzed Epoxy Gloss B73 Series
Third Coat WB Catalyzed Epoxy Gloss B73 Series

g. High Gloss – Industrial High Performance – Waterborne Epoxy/Urethane
First Coat — Macropoxy 646-100 B58 Series
Second Coat — Acrolon 100 WB Polyurethane B65 Series
Third Coat — Acrolon 100 WB Polyurethane B65 Series

2. Concrete & Plaster:
a. Flat – Acrylic Copolymer
First Coat — Loxon Primer LX2W50
Second Coat — ProMar 200 Zero VOC Flat B30-2600
Third Coat — ProMar 200 Zero VOC Flat B30-2600

b. Low Sheen – Acrylic Copolymer
First Coat — Loxon Primer LX2W50
Second Coat — ProMar 200 Zero VOC Low Sheen B24-2600
Third Coat — ProMar 200 Zero VOC Low Sheen B24-2600

c. Eggshell –Acrylic Copolymer
First Coat — Loxon Primer LX2W50
Second Coat — ProMar 200 Zero VOC Eg-shel B20-2600
Third Coat — ProMar 200 Zero VOC Eg-shel B20-2600

d. Semi-Gloss –Acrylic Copolymer
First Coat — Loxon Primer LX2W50
Second Coat — ProMar 200 Zero VOC Semigloss B31-2600
Third Coat — ProMar 200 Zero VOC Semigloss B31-2600

e. Gloss – 100% Acrylic
First Coat — Loxon Primer LX2W50
Second Coat — ProMar 200 Zero VOC Gloss B21-12650
Third Coat — ProMar 200 Zero VOC Gloss B21-12650

f. Gloss – Industrial High Performance - Waterborne Epoxy
First Coat — Loxon Primer LX2W50
Second Coat — WB Catalyzed Epoxy Gloss B73 Series
Third Coat — WB Catalyzed Epoxy Gloss B73 Series

g. High Gloss- Industrial High Performance - Epoxy/Urethane
First Coat — Macropoxy 646-100 B58 Series
Second Coat — Acrolon 100 WB Polyurethane B65 Series
Third Coat — Acrolon 100 WB Polyurethane B65 Series

4. Concrete Block
a. Flat – Acrylic Copolymer
First Coat — PrepRite Block Filler B25W25
Second Coat — ProMar 200 Zero VOC Flat B30-2600
Third Coat — ProMar 200 Zero VOC Flat B30-2600

b. Low Sheen – Acrylic Copolymer
First Coat — PrepRite Block Filler B25W25
Second Coat — ProMar 200 Zero VOC Low Sheen B24-2600
Third Coat — ProMar 200 Zero VOC Low Sheen B24-2600

c. Eggshell –Acrylic Copolymer
First Coat — PrepRite Block Filler B25W25
Second Coat — ProMar 200 Zero VOC Eg-shel B20-2600
Third Coat — ProMar 200 Zero VOC Eg-shel B20-2600

d. Semi-Gloss –Acrylic Copolymer
   First Coat — PrepRite Block Filler B25W25
   Second Coat — ProMar 200 Zero VOC Semigloss B31-2600
   Third Coat — ProMar 200 Zero VOC Semigloss B31-2600
e. Gloss – 100% Acrylic
   First Coat — PrepRite Block Filler B25W25
   Second Coat — ProMar 200 Zero VOC Gloss B21-12650
   Third Coat — ProMar 200 Zero VOC Gloss B21-12650

f. Gloss – Industrial High Performance - Waterborne Epoxy
   First Coat — PrepRite Block Filler B25W25
   Second Coat — WB Catalyzed Epoxy Gloss B73 Series
   Third Coat — WB Catalyzed Epoxy Gloss B73 Series

g. High Gloss- Industrial High Performance – Acrylic/Urethane
   First Coat — Heavy Duty Block Filler B42W46
   Second Coat — Macropoxy 646-100 B58 Series
   Third Coat — Acrolon 100 WB Polyurethane B65 Series

5. Ferrous Metal
   a. Flat – Acrylic Copolymer
      First Coat — ProCryl Universal Acrylic Metal Primer B66-310
      Second Coat — ProMar 200 Zero VOC Flat B30-2600
      Third Coat — ProMar 200 Zero VOC Flat B30-2600

   b. Low Sheen –Acrylic Copolymer
      First Coat — ProCryl Universal Acrylic Metal Primer B66-310
      Second Coat — ProMar 200 Zero VOC Low Sheen B24-2600
      Third Coat — ProMar 200 Zero VOC Low Sheen B24-2600

   c. Eggshell –Acrylic Copolymer
      First Coat — ProCryl Universal Acrylic Metal Primer B66-310
      Second Coat — ProMar 200 Zero VOC Eg-shel B20-2600
      Third Coat — ProMar 200 Zero VOC Eg-shel B20-2600

   d. Semi-Gloss – Acrylic Primer/ Acrylic Copolymer
      First Coat — ProCryl Universal Acrylic Metal Primer B66-310
      Second Coat — ProMar 200 Zero VOC Semigloss B31-2600
      Third Coat — ProMar 200 Zero VOC Semigloss B31-2600

   e. Semi-Gloss –Rust Preventative Acrylic
      First Coat — ProCryl Universal Acrylic Metal Primer B66-310
      Second Coat — ProIndustrial Acrylic SemiGloss
      Third Coat — ProIndustrial Acrylic SemiGloss

   f. Gloss – Acrylic Primer /100% Acrylic
      First Coat — ProCryl Universal Acrylic Metal Primer B66-310
      Second Coat — Solo Acrylic Latex Gloss A77 Series
      Third Coat — Solo Acrylic Latex Gloss A77 Series

   g. Gloss –Rust Preventative Acrylic
      First Coat — ProCryl Universal Acrylic Metal Primer B66-310
      Second Coat — ProIndustrial Acrylic Gloss
      Third Coat — ProIndustrial Acrylic Gloss

h. Gloss – Industrial High Performance - Waterborne Epoxy

First Coat	ProCryl Universal Acrylic Metal Primer B66-310
Second Coat	WB Catalyzed Epoxy Gloss B73 Series
Third Coat	WB Catalyzed Epoxy Gloss B73 Series

i. High Gloss – Industrial High Performance - Epoxy/Urethane

First Coat	Macropoxy 646-100 B58 Series
Second Coat	Acrolon 100 WB Polyurethane B65 Series
Third Coat	Acrolon 100 WB Polyurethane B65 Series

END OF SECTION

SECTION 10 14 00

SIGNAGE

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS
Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SCOPE OF WORK SUMMARY
Supply and install all exterior and interior signage, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete and proper installation.

1.03 STANDARDS AND REFERENCES
Comply with the Industry Standards and References as established by Manufacturer.

1.04 QUALITY ASSURANCE
Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.05 SUBSTITUTIONS
Substitutions will be considered per Section 01 25 00 Substitution Procedures.

1.06 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 Submital Procedures.
B. Provide:
    1. Shop Drawings: Provide shop drawings for review and approval prior to commencement of fabrication.
    2. Samples: Provide to illustrate full size sample sign, of type, style and color specified including method of attachment.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with the requirements of Section 01 66 00 Product Storage and Handling Requirements.
B. Package signs, labeled in name groups.
C. Store adhesive tape at ambient room temperatures.

1.08 PROJECT CONDITIONS
A. Comply with the requirements of Section 01 50 00 Construction Facilities.
B. Do not install signs when ambient temperature is below 70 degrees F. Maintain this minimum during and after installation of signs.

1.09 OPERATION AND MAINTENANCE DATA
Provide in accordance with Section 01 77 00 Project Closeout.

1.10 EXTRA MATERIALS
Provide in accordance with Section 01 77 00 Project Closeout.

1.11 RECORD DRAWINGS
Provide in accordance with Section 01 77 00 Project Closeout.

1.12 WARRANTY

Provide Manufacturer's Standard Warranty in accordance with Section 01 78 36 Warranties.

PART 2 – PRODUCTS

2.01 MATERIALS – ROOM IDENTIFICATION SIGNAGE

A. Refer to Signage Plan for types and locations.
B. Material: 1/8" thick ES Plastic.
C. Size and color: As indicated in Drawings
D. Graphics: Vinyl die-cut. Font to be 3/4" Helvetic Medium, All Caps.
E. All signage to have 1/2" radius corners
F. Mounting: Adhesive
G. All signs installed on glass shall have a full-size backing plate adhered to the opposite side of the glass of the same color as the sign.

2.02 MATERIALS – INTERIOR ADA SIGNAGE

A. Types and locations: As indicated in Drawings, conforming to requirements of the California Building Code.
B. Material: 1/8" thick ES Plastic.
C. Text and font, size and color: As indicated in Drawings
D. Graphics: To be vinyl die-cut.
E. All signs to have 1/2" Radius corners
F. Mounting: Adhesive
G. All signs installed on glass shall have a full size backing plate adhered to the opposite side of the glass of the same color as the sign.

2.03 DEDICATION PLAQUE

Refer to Drawings for location, size, text, and material details.

2.04 ACCESSORIES

A. Mounting Hardware: Chrome screws; base sleeve and studs per manufacturer's recommendations.
B. Tape Mount: Double sided tape, permanent adhesive.
C. Adhesive: Silastic adhesive as recommended by manufacturer.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which work of this Section will be performed.
B. Verify adequate support for Building Signs. Coordinate footings with other trades.
C. Correct conditions detrimental to timely and proper completion of the Work.
D. Do not proceed until unsatisfactory conditions are corrected.

E. Beginning of installation means acceptance of conditions.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install signs after doors and surfaces are finished, in locations indicated.

1. Furnish and install all anchorage devices required to install the item and its appurtenances complete. Provide anchorage in ample time when required to be built in by other trades.

2. All wall-mounted items shall be securely fastened to solid backing or blocking.

C. Center plastic signs on doors, level.

D. Anchor all components firmly into position for long life under hard use.

E. Clean and polish.

END OF SECTION

SECTION 10 22 26

OPERABLE PARTITIONS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Manually operated, paired panel operable partitions.

B. Related Sections include the following:
   1. Division 03 Sections for concrete tolerances required.
   2. Division 05 Sections for primary structural support, including pre-punching of support members by structural steel supplier per operable partition supplier's template.
   3. Division 06 Sections for wood framing & supports, and all blocking at head and jambs as required.
   4. Division 09 Sections for wall and ceiling framing at head and jambs.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified in writing by the operable partition manufacturer, as qualified to install the manufacturer's partition systems for work similar in material, design, and extent to that indicated for this Project.

B. Acoustical Performance: Test operable partitions in an independent acoustical laboratory in accordance with ASTM E90 test procedure and classified in accordance with ASTM E413 to attain no less than the STC rating specified. Provide a complete and unedited written test report by the testing laboratory upon request.

C. Preparation of the opening shall conform to the criteria set forth per ASTM E557 *Standard Practice for Architectural Application and Installation of Operable Partitions.*

D. The operable wall must be manufactured by a certified ISO-9001-2015 company or an equivalent quality control system.

1.4 REFERENCE STANDARDS

A. ASTM International
   1. ASTM E557 Standard Practice for Architectural Application and Installation of Operable Partitions.
   2. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
   3. ASTM C1036 - Standard Specification for Flat Glass.
   4. ASTM C1048 - Heat-Treated Flat Glass—Kind HS, Kind FT Coated and Uncoated Glass.
   5. ASTM E84 - Surface Burning Characteristics of Building Materials.
   6. ASTM E413 - Classification for Rating Sound Insulation

B. Health Product Declaration Collaborative
   1. Health Product Declaration Open Standard v2.1

C. International Standards Organization
   1. ISO 14021 - Environmental Labels and Declarations - Self-Declared Environmental Claims (Type II Environmental Labeling).
   2. ISO 14025:2011-10, Environmental Labels and Declarations - Type III Environmental Declarations - Principles and Procedures.
   3. ISO 14040:2009-11, Environmental Management - Life Cycle Assessment - Principles and Framework.
   4. ISO 14044:2006-10, Environmental Management - Life Cycle Assessment - Requirements and Guidelines.
   5. ISO 21930 – Sustainability in Buildings and Civil Engineering Works — Core Rules for Environmental Product Declarations of Construction Products and Services.

D. Other Standards
   1. ADA – Americans with Disabilities Act.
   2. ANSI Z97.1 - Safety Glazing Materials Used in Buildings.
   3. CPSC 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.
   4. NEMA LD3 - High Pressure Decorative Laminates.

1.5 SUBMITTALS

A. Product Data: Material descriptions, construction details, finishes, installation details, and operating instructions for each type of operable partition, component, and accessory specified.

B. Shop Drawings: Show location and extent of operable partitions. Include plans, elevations, sections, details, attachments to other construction, and accessories. Indicate dimensions, weights, conditions at openings, and at storage areas, and required installation, storage, and operating clearances. Indicate location and installation requirements for hardware and track, including floor tolerances required and direction of travel. Indicate blocking to be provided by others.

C. Setting Drawings: Show imbedded items and cutouts required in other work, including support beam punching template.

D. Samples: Color samples demonstrating full range of finishes available by architect. Verification samples will be available in same thickness and material indicated for the work.

E. Reports: Provide a complete and unedited written sound test report indicating test specimen matches product as submitted.

F. Create spaces that are healthy for occupants.
   1. Furnish products and materials with Health Product Declaration (HPD), Manufacturer Inventory, or other material health disclosure documentation. Products without an HPD or other disclosure documentation are not acceptable.

G. Furnish materials that generate the least amount of pollution.
   1. Furnish products and materials that have third party verified environmental product declarations (EPD's). Consider products and materials that have optimized environmental performance (reduced life cycle impacts). Products without an EPD or other disclosure documentation are not acceptable.

H. Buy American: Folding door to be manufactured in the United States in compliance with applicable U.S. Federal Trade Commission (FTC) and U.S. Customs Service and Border Protections regulations and be labeled "Made in America".

1.6 DELIVERY, STORAGE, AND HANDLING

A. Clearly mark packages and panels with numbering systems used on Shop Drawings. Do not use permanent markings on panels.
B. Protect panels during delivery, storage, and handling to comply with manufacturer's direction and as required to prevent damage.

1.7 WARRANTY

A. Provide written warranty by manufacturer of operable partitions agreeing to repair or replace any components with manufacturing defects.
B. Warranty period: Two (2) years.
C. Suspension System Warranty:
    1. OP-01: Five (5) years.

PART 2 – PRODUCTS

2.1 MANUFACTURERS, PRODUCTS, AND OPERATION

A. Manufacturers: Subject to compliance with requirements, provide product by the following:
    1. Modernfold, Inc.
B. Doors to be manufactured in the U.S.A.
C. Products: Subject to compliance with the requirements, provide the following product:
    1. OP-01: Acousti-Seal Premier - Paired Panel: Manually operated paired panel operable partition.

2.2 OPERATION

A. OP-01: Acousti-Seal Premier - Paired Panel: Series of paired flat panels hinged together in pairs, manually operated, top supported with operable floor seals.
B. Final Closure:
    1. OP-01: Horizontally expanding panel edge with removable crank

2.3 PANEL CONSTRUCTION

A. OP-01: Nominal 3-inch (76mm) thick panels in manufacturer's standard 48-inch (1220mm) widths. All panel horizontal and vertical framing members fabricated from minimum 18-gage formed steel with overlapped and welded corners for rigidity. Top channel is reinforced to support suspension system components. Frame is designed so that full vertical edges of panels are of formed steel and provide concealed protection of the edges of the panel skin.
B. Panel skin shall be:
    1. OP-01: 0.50-inch (13mm) tackable 100% recycled gypsum board, class "A" rated single material or composite layers continuously bonded to panel frame. Acoustical ratings of panels with this construction minimum:
        a. 50 STC
C. Hinges for Panels, Closure Panels, Pass Doors, and Pocket Doors shall be:
    1. OP-01: Full leaf butt hinges, attached directly to the panel frame with welded hinge anchor plates within panel to further support hinge mounting to frame. Lifetime warranty on hinges. Hinges mounted into panel edge or vertical astragal are not acceptable.
D. Panel Trim: No vertical trim required or allowed on edges of panels; minimal groove appearance at panel joints.

E. Panel Weights:
   1. OP-01: 50 STC - 8 lbs./square foot

2.4 PANEL FINISH

A. Panel finish shall be:
   1. OP-01: Reinforced vinyl with woven backing weighing not less than 20 ounces (567 grams) per lineal yard.
B. Panel Trim: Exposed panel trim of one consistent color:
   1. OP-01: To Be Advised

2.5 SOUND SEALS

A. Vertical Interlocking Sound Seals between panels: Roll-formed steel astragals, with reversible tongue and groove configuration in each panel edge for universal panel operation. Rigid plastic or aluminum astragals or astragals in only one panel edge are not acceptable.
B. Horizontal Top Seals: Continuous contact extruded vinyl bulb shape with pairs of non-contacting vinyl fingers to prevent distortion without the need for mechanically operated parts.
C. Horizontal bottom floor seals shall be:
   1. OP-01: Modernfold IA2 Bottom seal. Automatic operable seals providing nominal 2-inch (51mm) operating clearance with an operating range of +0.50-inch (13mm) to -1.50-inch (38mm) which automatically drop as panels are positioned, without the need for tools or cranks.

2.6 SUSPENSION SYSTEM

A. OP-01: #17 Suspension System
   1. Suspension Tracks: Minimum 11-gauge, 0.12-inch (3.04mm) roll-formed steel track, suitable for either direct mounting to a wood header or supported by adjustable steel hanger brackets, supporting the load-bearing surface of the track, connected to structural support by pairs of 0.38-inch (10mm) diameter threaded rods. Aluminum track is not acceptable.
      a. Exposed track soffit: Steel, integral to track, and pre-painted off-white.
   2. Carriers: One all-steel trolley with steel tired ball bearing wheels per panel (except hinged panels). Non-steel tires are not acceptable.

2.7 OPTIONS

A. (NONE SELECTED)

PART 3 – EXECUTION

3.1 INSTALLATION

A. General: Comply with ASTM E557, operable partition manufacturer's written installation instructions, Drawings and approved Shop Drawings.
B. Install operable partitions and accessories after other finishing operations, including painting have been completed.
C. Match operable partitions by installing panels from marked packages in numbered sequence indicated on Shop Drawings.
D. Broken, cracked, chipped, deformed or unmatched panels are not acceptable.

3.2 CLEANING AND PROTECTION

A. Clean partition surfaces upon completing installation of operable partitions to remove dust, dirt, adhesives, and other foreign materials according to manufacturer’s written instructions.

B. Provide final protection and maintain conditions in a manner acceptable to the manufacturer and Installer that ensure operable partitions are without damage or deterioration at time of Substantial Completion.

3.3 ADJUSTING

A. Adjust operable partitions to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and other moving parts.

3.4 EXAMINATION

A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable partitions. Proceed with installation only after unsatisfactory conditions have been corrected.

3.5 DEMONSTRATION

A. Demonstrate proper operation and maintenance procedures to Owner's representative.

B. Provide Operation and Maintenance Manual to Owner's representative.

END OF SECTION

SECTION 10 26 00

WALL PROTECTION SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SCOPE OF WORK SUMMARY

A. Supply and install all Wall Protection Systems, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete and proper installation.
B. Section includes, but is not limited to:
    1. Corner Guards
C. Related Section: Blocking in walls for fasteners

1.03 STANDARDS AND REFERENCES

Comply with the Industry Standards and References as established by Manufacturer.

1.04 QUALITY ASSURANCE

A. Installer qualifications: Engage an installer who has experience in installation of systems similar in complexity to those required for this project.
B. Manufacturer's qualifications: Not less than 5 years of experience in the production of specified products and a record of successful in-service performance.
C. Code compliance: Assemblies should conform to all applicable codes including IBC, UBC, SBCCI, BOCA, Life Safety and CA 01350.
D. Fire performance characteristics: Provide wall protection system components with UL label indicating that they are identical to those tested in accordance with ASTM E84 for Class A/1 characteristics listed below:
    1. Flame spread: 25 or less.
    2. Smoke developed: 450 or less.
E. Impact strength: Provide wall protection components that have been tested in accordance with the applicable provisions of ASTM F476.
F. Chemical and stain resistance: Provide wall protection system components with chemical and stain resistance in accordance with ASTM D543.
G. Color match: Provide wall protection components that are color matched in accordance with the following: Delta Ecmc of no greater than 1.0 using CIELab color space. (Specifier note: Construction Specialties' colors are matched under cool white fluorescent lighting and computer controlled within manufacturing tolerances. Color may vary if alternate lighting sources are present.)
H. Single source responsibility: Provide all components of the wall protection system manufactured by the same company to ensure compatibility of color, texture and physical properties.

1.05 SUBSTITUTIONS

Substitutions will be considered per Section 01 25 00 Substitution Procedures.

1.06 SUBMITTALS

A. Submit in accordance with Section 01 33 00 Submittal Procedures.

B. Product data and detailed specifications for each system component and installation accessory required, including installation methods for each type of substrate.
C. Product test reports from a qualified independent testing laboratory showing compliance of each component with requirements indicated.
D. Shop drawings showing locations, extent and installation details of wall covering products.
E. Samples of each product specified for verification purposes: Submit samples as proposed for this work, for verification of color, texture, pattern and thickness.
F. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship

1. Locate mock-ups on site in locations and size directed by Architect. The mock-up may be part of the work and may be incorporated into the finish when so accepted by the Architect.
2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
3. Refinish mock-up area as required to produce acceptable work.
4. Retain and maintain mock-ups during construction in undisturbed condition as a standard for judging completed unit of Work.
5. Obtain Architect's acceptance of mock-ups before start of final unit of Work.
6. Mock-up may remain as part of work if acceptable to Architect.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with the requirements of Section 01 66 00 Product Storage and Handling Requirements.
B. Deliver materials to the project site in unopened original factory packaging clearly labeled to show manufacturer.
C. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 55 degrees F (13 degrees C) or more than 85 degrees F (29 degrees C).
D. Materials must be stored flat.

1.08 PROJECT CONDITIONS

A. Materials must be acclimated in an environment of 65-75 degrees F (18-24 degrees C) for at least 24 hours prior to beginning installation.
B. Installation areas must be enclosed and weatherproofed before installation commences.
C. Install products after other finishing operations, including painting, have been completed.

1.09 OPERATION AND MAINTENANCE DATA

Provide in accordance with Section 01 77 00 Project Closeout.

1.10 EXTRA MATERIALS

Comply with the requirements of Section 01 77 00 Project Closeout. Provide 5 percent extra material for each type, color, pattern, and accessory.

1.11 WARRANTY

Provide Manufacturer's Standard Warranty in accordance with Section 01 78 36 Warranties.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Basis of Design: Construction Specialties, Inc.
B. Or Architect approved equal.

2.02 CORNER GUARD

(Note: Add specific information for each type)

2.03 INSTALLATION ACCESSORIES

A. Fasteners: All fasteners to be non-corrosive and compatible with aluminum retainers. All necessary fasteners to be supplied by corner guard manufacturer.
B. Adhesive: Standard type as recommended by manufacturer to suit products and substrate conditions.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the work.
B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface preparation: Prior to installation, clean substrate to remove dirt, debris and loose particles. Perform additional preparation procedures as required by manufacturer's instructions.
B. Protection: Take all necessary steps to prevent damage to material during installation as required in manufacturer's installation instructions.

3.03 INSTALLATION

A. Install the work of this section in strict accordance with the manufacturer's recommendations using approved adhesive where applicable.
B. Temperature at the time of installation must be between 65-75 degrees F (18-24 degrees C) and be maintained for at least 48 hours after the installation to allow for proper adhesive set-up.
C. Relative humidity shall not exceed 80 percent.

3.04 CLEANING AND PROTECTION

A. General: Immediately upon completion of installation, clean material in accordance with manufacturer's recommended cleaning method.
B. Remove surplus materials, rubbish and debris resulting from installation as work progresses and upon completion of work.
C. Protect installed materials to prevent damage by other trades. Use materials that may be easily removed with out leaving residue or permanent stains.

END OF SECTION

SECTION 10 28 13

TOILET ACCESSORIES

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SCOPE OF WORK

Supply and install all Toilet Accessories, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.

1.03 STANDARDS AND REFERENCES

A. Comply with the Industry Standards and References as established by Manufacturer.
B. Regulatory: Conform to Title 24 and City codes for installing work in conformance with ANSI A117.1

1.04 QUALITY ASSURANCE

A. Comply with the Standard requirements established by Manufacturer.
B. Coordinate the work of this Section with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBSTITUTIONS

Substitutions will be considered per Section 01 25 00 Substitution Procedures.

1.06 SUBMITTALS

A. Submit in accordance with Section 01 33 00 Submittal Procedures.
B. Provide, within 35 days of Notice to Proceed, product data on accessories describing size, finish, details of function, attachment methods.
C. Submit shop drawings, manufacturer's literature and brochures, and catalog cuts, showing complete details of all manufactured and fabricated items. Do not purchase items until the shop drawings have been approved. See Section "Samples and Shop Drawings" for number and manner of submittals.

1.07 DELIVERY, STORAGE, AND HANDLING

Comply with the requirements of Section 01 66 00 Product Storage and Handling Requirements.

1.08 PROJECT CONDITIONS

A. Comply with the requirements of Section 01 50 00 Construction Facilities.
B. Materials must be acclimated in an environment of 65-75ºF (18-24ºC) for at least 24 hours prior to beginning the installation.
C. Installation areas must be enclosed and weatherproofed before installation commences.

1.09 OPERATION AND MAINTENANCE DATA

Submit in accordance with Section 01 77 00 Project Closeout.

A. Supply two (2) keys for each accessory to Owner. Master Key all accessories.

1.10 WARRANTY

Provide Standard Warranty in accordance with Section 01 78 36 Warranties.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

Bobrick Washroom Equipment, Inc.; Bradley Corporation or Architect approved equal.

2.02 MATERIALS

A. Stainless Steel Sheet: ASTM A167, Type 304.
B. Tubing: ASTM A269, stainless steel.
C. Fasteners, Screws, and Bolts: Hot dip galvanized as recommended by manufacturer.
D. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.
E. Factory Finishing: Stainless Steel, No. 4 satin luster finish.

2.03 PRODUCTS

As indicated on the Toilet Accessories Schedule in the Drawings.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which work of this Section will be performed.
B. Verify that site conditions are ready to receive work and dimensions are as instructed by the manufacturer.
C. Correct conditions detrimental to timely and proper completion of the Work.
D. Do not proceed until unsatisfactory conditions are corrected.
E. Beginning of installation means acceptance of conditions.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site at appropriate time for building-in.
B. Provide complete information, diagrams, templates, and instructions for the installation of all items, in sufficient time so that all backing, blocking, framing and formwork can be properly installed, and so that the work of other trades will not be delayed.
C. Verify exact location of accessories for installation.

3.03 INSTALLATION

A. Install the work of this Section in strict accordance with the manufacturer's recommended installation procedures as approved by the Architect, anchoring all components firmly into position for long life under hard use.
    1. Furnish and install all anchorage devices required to install the item and its appurtenances complete. Provide anchorage in ample time when required to be built in by other trades.
    2. All wall-mounted items shall be securely fastened to solid backing or blocking.
B. Install fixtures, accessories and items in accordance with manufacturer's instructions.
C. Install plumb and level, securely and rigidly anchored to substrate.

END OF SECTION

SECTION 10 44 00

FIRE PROTECTION SPECIALTIES

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SCOPE OF WORK SUMMARY

Supply and install all Fire Extinguishers and Cabinets, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation

1.03 STANDARDS AND REFERENCES

Comply with the Industry Standards and References as established by Manufacturer

1.04 QUALITY ASSURANCE

A. Conform to NFPA 10 requirements for extinguishers.
B. Provide fire extinguishers, cabinets, and accessories by single manufacturer.

1.05 SUBSTITUTIONS

Substitutions will be considered per Section 01 25 00 Substitution Procedures.

1.06 SUBMITTALS

A. Submit in accordance with Section 01 33 00 Submittal Procedures.
B. Submit the following:
    1. Physical dimensions, operational features, color and finish, wall-mounting brackets with mounted measurements, anchorage details, rough-in measurements, location, and details.
    2. Manufacturer's installation instructions.
    3. Manufacturer's operation and maintenance data.
    4. Include test, refill or recharge schedules, procedure, and re-certification requirements.

1.07 DELIVERY, STORAGE AND HANDLING

A. Comply with Section 01 66 00 Product Storage and Handling Requirements.
B. Do not install extinguishers when ambient temperatures may cause freezing.

1.08 PROJECT CONDITIONS

A. Comply with the requirements of Section 01 50 00 Construction Facilities.
B. Comply with Manufacturer’s Standard Requirements.

1.09 OPERATION AND MAINTENANCE DATA

Provide in accordance with Section 01 77 00 Project Closeout.

1.10 WARRANTY

Provide Standard Warranty in accordance with Section 01 78 36 Warranties.

PART 2 – PRODUCTS

2.01 MANUFACTURER

Basis of Design: Larsen's Manufacturing Company, 7421 Commerce Lane, N.E. Minneapolis, MN. 55432. Website: www.larsensmfg.com. Phone: 1-800-527-7367.

2.02 EXTINGUISHERS

Multi-Purpose Chemical Type: Larsen's Steel tank, Model MP 5, with pressure gage, and UL Rating 2A-10B:C or approved equal.

2.03 CABINETS

Typical Extinguisher Cabinet:

A. Provide Larsen's 2409-5R Vertical Duo Door Panel cabinet.
B. Primer finish.

2.04 ACCESSORIES

A. Mounting Hardware: Appropriate to cabinet - see manufacturer's installation instructions.
B. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

2.05 FABRICATION

A. Form body of cabinet with tight inside corners and seams.
B. Pre-drill holes for anchorage.
C. Form perimeter trim and door stiles by welding, filling, and grinding smooth.
D. Hinge doors for 180 degree opening.
E. Glaze doors with resilient channel gasket glazing.

2.06 FINISHES

A. Extinguisher: Red enamel.
B. Cabinet Trim and Door: Primed to be painted to match adjacent surface.
C. Cabinet Interior: Enamel white.

PART 3 – EXECUTION

3.01 INSPECTION

A. Examine the areas and conditions under which work of this Section will be performed.
B. Verify that rough openings for cabinet are correctly sized and located.
C. Correct conditions detrimental to timely and proper completion of the Work.
D. Do not proceed until unsatisfactory conditions are corrected.
E. Beginning of installation means acceptance of conditions.

3.02 INSTALLATION

A. Install cabinets plumb and level in wall openings so that there is 54 inches from finished floor to door handle.
B. Secure rigidly in place in accordance with manufacturer's instructions.

END OF SECTION

SECTION 10 51 13

METAL LOCKERS

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. 15-inch Wide Single-Tier Standard Metal Lockers.
- B. 15-inch Wide Double-Tier Standard Metal Lockers
- C. 15-inch Wide Triple-Tier Standard Metal Lockers.

1.2 REFERENCES
- A. ADAAG - Americans with Disabilities Act, Accessibility Guidelines.
- B. IBC - International Building Code.

1.3 RELATED SECTIONS
- A. Section 03300 (03 30 00) – Cast-in-Place Concrete: Concrete bases.
- B. Section 06100 (06 10 00) – Rough Carpentry: Wood ground and furring for anchoring lockers.
- C. Section 09650 (09 65 13.13) – Resilient Base.

1.4 SUBMITTALS
- A. Submit under provisions of Section 013300.
- B. Product Data - Manufacturer's data sheets on each product to be used, including:
  1. Preparation instructions and recommendations.
  2. Storage and handling requirements and recommendations.
  3. Installation methods.
- C. Shop Drawings: Prepared specifically for this project; show dimensions of lockers and interface with other products.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns. .

1.5 QUALITY ASSURANCE
- A. Manufacturer Qualifications: Manufacturer shall have a Quality System in place to ensure and be able to substantiate that manufactured units conform to requirements and match the approved design and must be ISO 9001:2015 certified.

1.6 DELIVERY, STORAGE, AND HANDLING
- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Locker components shall be stored flat, if shipped unassembled, until assembly. All finishes shall be protected from soiling and damage during handling.
- C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 WARRANTY
- A. Manufacturer's standard warranty to repair or replace components of locker products that fail in materials or workmanship within 3 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Salsbury Industries, 18300 Central Avenue, Carson, CA 90746-4008; Toll Free Telephone: 1-800-LOCKERS (1-800-562-5377); Fax: 1-800-562-5399; Email: salsbury@lockers.com; Website: www.lockers.com.

2.2 LOCKERS

Single-tier, double-tier and triple-tier 15-inch wide standard metal lockers: Constructed of 16 gauge steel; durable powder coated finish; includes a lift up handle and recessed hasp for added security; can accommodate built-in combination locks, built-in key locks, combination padlocks, key padlocks or factory installed resettable combination locks.

A. 15-inch Wide Standard Metal Locker Series:
   3. 53000 series: Triple-tier.

B. Unit Width: 15 inches (381 mm).

C. Unit Height:
   1. 78 inches (1,981 mm) with legs.
   2. 76 inches (1,930 mm) with zee base.
   3. 72 inches (1,828 mm) without legs.

D. Unit Depth:
   2. 18 inches (457 mm).

E. Unit Assembly:
   1. Unassembled units (Knocked-down).
   2. Assembled units.

F. Unit Color:
   1. Color: Gray - standard.
   2. Color: Tan - standard.
   3. Color: Blue - standard.

2.3 INTERIOR EQUIPMENT

A. ADA-Compliant Lockers (Recessed Handles with Multi-Point Latch):
   1. Single-tier, double-tier and triple-tier lockers: Additional shelf at maximum 48 inches (1,219 mm) above the floor for unobstructed forward and side reach.
   2. Locker Compartment Bottom: Minimum of 15 inches (381 mm) above the floor or an extra shelf placed 15 inches (381 mm) above the floor for unobstructed forward and side reach.
   3. Hooks and rods as specified.

B. Standard Hardware Features:
   1. Padlock hasp.
   2. One top-mounted, two-pronged stainless steel coat hook.
   3. Three wall-mounted, single-prong stainless steel coat hooks.
   4. Horizontal venting.

5. Five knuckle door hinges.
6. Adjustable hat shelf (51000 series only).
7. Coat rod (models 51168 and 51368 only).

2.4 OPTIONAL EQUIPMENT

A. Sloping hoods.
B. Base panels – 6 inches (152 mm) high:
   1. Front base.
   2. End base.
C. Fillers:
   1. Flat top fillers:
      a. Flat top in-line top fillers.
      b. Flat top corner fillers.
   2. Sloping hood fillers:
      a. Sloping in-line top fillers.
      b. Sloping corner fillers.
   3. Front fillers:
      a. 9 inches (229 mm) wide filler panels.
      b. 15 inches (381 mm) wide filler panels.
D. Finished end panels:
   1. Single end panel for end of unit rows.
   2. Double end panel for back-to-back unit installations.
E. Built-In Locks:
   1. Built-in combination locks.
   2. Built-in keyed locks.
   3. Factory installed resettable combination locks.
F. Padlocks:
   1. Combination padlocks.
   2. Keyed padlocks.
G. Master keys:
   1. Master control key for built-in combination locks.
   2. Master control key for built-in keyed locks.
   3. Master control key for factory installed resettable combination locks.
   4. Master control key for combination padlocks.
H. Additional compartment shelf.
I. Engraved name/number plates.

J. Locker unit legs shall be supplied, unless otherwise specified, at 6 inches (152 mm) high in same color as locker unit. Locker bases shall be fabricated from 0.0625 inch (1.59 mm) thick steel sheet.

K. Locker zee base kit – 4 inches (102 mm) high by 72 inches (1828 mm) in length in same color as locker unit. Locker zee base kits shall be fabricated from 0.0625 inch (1.59 mm) thick steel sheet.
   1. 15 inches (381 mm).
   2. 18 inches (457 mm).

L. Lockers without legs.

M. Anchoring Brackets - For use in lockers without legs.

2.5 CONSTRUCTION

A. Locker Doors: Steel specially formed for added strength and rigidity and to ensure tight joints at fastening points.
   1. Door:
      a. 16 gauge - .060 inch (1.52 mm) thick steel.
      b. Holes provided for attaching number plates.
   2. Ventilation: Vents provided on each door in Salsbury Industries' standard louver pattern.
      a. Single-tier lockers – 6 feet high units:
      Four 5-3/4 inch (146 mm) louvers top and bottom.
      b. Double-tier lockers – 6 feet high units:
      Four 5-3/4 inch (146 mm) louvers top and bottom.
      c. Triple-tier lockers – 6 feet high units:
      Two 5-3/4 inch (146 mm) louvers top and bottom.
   3. Multi-Point Latch: Full channel formation of adequate depth to fully conceal lock bar on lock side, channel formation on hinge side, right angle formations across top and bottom.

B. Locker Body: Solid steel specially formed for added strength and rigidity and to ensure tight joints at fastening points.

C. Hinges: Hinge: 0.074 inch (1.88 mm) thick sheet steel, double spun, full loop, tight pin, projection welded to door frame and securely fastened to the door.
   1. Single-tier lockers: Three 2 inch (51 mm) high five-knuckle hinges.
   2. Double-tier & triple-tier lockers: Two 2 inch (51 mm) high five-knuckle hinges.

D. Optional factory assembly of locker bodies using heavy duty steel rivets.

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.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with Salsbury Industries' installation instructions.

B. Anchor the units to the wall studs through the locker back and to the floor.

C. Lockers can be either floor-mounted or installed on concrete or wood bases as scheduled or indicated. Floor or base shall be level for proper installation.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 11 53 00

LABORATORY EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install all laboratory equipment as shown and specified. Divisions 23 and 26 shall be responsible for final connections of fixtures and accessories specified herein.

B. Equipment items specified in this Section include the following:

Equipment Item	***Equipment Number***
Task Exhaust Units - Ceiling Mounted	**TE1**
Laboratory Refrigerator/Freezer Combination Units	**R2**
Laboratory Freezer Units	**F1**
PCR Enclosure	**FB18**
Safety Supply Cabinet	**SSC**
First Aid Kit	Inside SSC
Burn Kit	Inside SSC
Laboratory Coat Hook Strips	**CH1 / CH3**
Lab Coat Rack & Shelf	**CR**
Laboratory Spill Cart	**SC**
Laboratory Paper Towel Dispenser	**PTD**
Deionized Water Polisher (Type 1 and 3)	**WP1**

C. Refer to Divisions 22, 23 and 26 and the mechanical and electrical drawings for related plumbing, mechanical and electrical work.

D. Equipment item locations are indicated in the lab plans by means of equipment numbers. The corresponding equipment number for each specified equipment item is also included in this specification.

1.2 RELATED DOCUMENTS: The completion of the work described in this Section may require work in or coordination with other Sections of these specifications. The Contractor and the subcontractor will be responsible for identifying and including all related work in other Sections of these specifications and/or drawings necessary for a complete installation of the work described in this Section. These related Sections include, but are not limited to the following:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this Section.

B. Division 11 53 13: Laboratory Fume Hoods.

C. Division 12 35 53: Laboratory Casework, Fixtures and Accessories.

D. Division 6 & 9: Blocking and backing in walls for anchorage of equipment.

E. Refer to Divisions 22, 23 and 26 and the mechanical and electrical drawings for related plumbing, mechanical and electrical work.

1.3 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this Section with a minimum of five years' documented experience.

1.4 SUBMITTALS

A. Submit under provisions of Division 1, General Requirements.

B. Product Data: Provide manufacturer's technical data, including equipment dimensions and construction, equipment capacities, physical dimensions, utility and service requirements and locations, point loads and factory finishes.

C. Manufacturer's Installation Instructions: Indicate special installation requirements.

D. Shop Drawings: Indicate equipment locations, large-scale plans, elevations, cross Sections, details, plumbing and electrical rough-in and anchor placement dimensions and tolerances and clearances required.

E. Coordination Drawings: Equipment shall be fully coordinated with lab casework and other lab equipment. Prepare a coordination drawing showing locations of surrounding casework and equipment and required clearances between them. At all under-counter applications, verify that refrigeration units fit under the as-built counter height. At units that do not fit under the counter, provide replacement models that do fit in these applications.

1.5 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

1.6 QUALITY ASSURANCE

A. Installers: Installation of the equipment specified under this Section shall be undertaken by the manufacturer's crew of installers, or a crew of installers who are approved in writing by the manufacturer. In either case, the installation of equipment specified under this Section shall remain the responsibility of the manufacturer as a subcontractor to the General Contractor.

1.7 CLOSEOUT SUBMITTALS: OPERATION AND MAINTENANCE DATA

A. Submit information in bound manual form, typed or computer word processed, on 8-1/2"x11" paper.

B. Operation Data: Include description of equipment operation, adjustments and testing required.

C. Maintenance Data: Identify system maintenance requirements, servicing cycles and spare part sources.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products in such a manner as to minimize the risk of damage, decay, deterioration or loss from theft.

B. All products shall be delivered to the job site in manufacturer's original unopened containers, crates or protective wrappings with the manufacturer's name and address clearly labeled thereon.

C. Accept products on site and inspect on arrival for damage.

1.9 WARRANTY

A. Provide warranty under provisions of Division 1.

PART 2 - PRODUCTS

2.1 ACCEPTABLE PRODUCTS

A. Subject to compliance with these specifications, acceptable products include, but are not limited to, those items indicated in Section 2.2, under each individual product. Products by other manufacturers submitted as equals will be reviewed for conformance with the specifications.

2.2 LABORATORY EQUIPMENT

A. General Requirements

1. All material and equipment specified under this Section shall be designed and constructed specifically for use in wet chemistry, serological and/or toxicological laboratory environments. Manufactured equipment units must meet or exceed applicable performance, reference and certification standards.

2. Dimensions, capacities and specific requirements are nominal, and may vary depending on the manufacturer.

B. Task Exhaust Unit: All task exhaust by Movex Inc., 5966 Keystone Dr., Bath, PA 18014, United States; Ph.: 610-440-0478; www. movexinc.com, or approved equal prior to bid.

Equipment Number: **TE1** = (75-100 CFM) – Articulating Ceiling Mounted Task Exhaust

ME100 – MET 1650-100 (75 mm / 4”ø duct) without light and without user controlled damper, by Movex Inc. or approved equal prior to bid.

1. General: Provide and install units as shown on the drawings. Total reach of flexible arms shall be 59”, with dimension of the ‘A’ starting Section to the “10”, arm Section ‘B’ to be 30” and arm Section ‘C’ to be 17.5”. Diameter of Sections to be 4”. Provide ceiling brackets as required (**TE1**) for the task exhaust mounting height of 84” (88”) AFF (Verify in field). Funnel head shall be movable around the work surface by means of triple-joint / swivel-base design, and may be placed stationary at any location. Units shall **NOT** include a damper control mechanism. Provide and install units as shown on the drawings. Fixtures shall be ceiling mounted. Exact location of ceiling mount shall be located and coordinated by the laboratory equipment subcontractor in the shop drawings and coordinated to the reflected ceiling plans.

   a. Equipment supplier shall be responsible for all interfacing steel above the ceiling for the support and anchorage of the task exhaust unit.

2. Materials: Arm pipes shall be manufactured of Anodized Aluminum (SS4104).

3. Exhaust System: Task exhaust units shall be ducted to the building exhaust system as indicated in the mechanical drawings or as recommended by the manufacturer. Extend duct, concealed above ceiling to the laboratory exhaust system as indicated in mechanical drawings. Laboratory equipment subcontractor shall provide a coordination drawing showing optimum ducting arrangements. Exhaust airflow at funnel shall be between 75 and 100 CFM.

4. Local Controls: Each unit shall NOT be provided with a damper to control exhaust rates individually and shall be constant volume flow.

5. Accessories: Provide each task exhaust unit with two hood units. These hoods are to be easily interchanged by lab staff to suit their particular needs. Additionally, provide ceiling bracket and all other required mounting devices for a complete and operations installation. Provide the following hoods:

   a. Hood 1: 10”Ø Round Metal Hood with powder coated aluminum finish.

   b. Hood 2: 14.75” x 10” Flat Screen Hood.

6. Task exhaust unit shall be seismically anchored as required by local codes.
7. Interfacing Steel: The manufacturer shall provide all interfacing steel for the proper support and anchorage of the task exhaust systems to the building structure above. Provide as part of shop drawings a coordination drawing showing all required blocking and interfacing steel, concealed in ceiling.
8. Ceiling Bracket: 40" standard mounting bracket or as required to achieve a base mounting height of 84" AFF. Provide escutcheon plate at the ceiling penetration.

C. Laboratory Refrigeration Units (See Table below for Equipment Number): Laboratory freezers and combination refrigerator / freezer model numbers noted below area all to be manual-defrost wbased on Thermo Fisher Scientific models as manufactured by Revco Laboratory Products, Asheville, NC, 800-252-7100, 828-365-1254, trace.bates@thermofisher.com, or equivalent products by Puffer Hubbard Jewett.

1. Cabinet Construction: Foamed-in-place, CFC-free urethane insulation with acrylic-coated steel housing and lining. All materials and construction shall be designed to meet UL, NFPA and OSHA criteria for safety, performance and certification for laboratory use.
2. Refrigeration System: Heavy-duty industrial hermetically sealed and insulated compressor. Positive, forced-air circulation system designed to maintain uniform cabinet temperature throughout. Operating temperature shall be adjustable between temperatures scheduled below.
3. Capacity: As listed in manufacturer's literature for each refrigerator noted below. Provide refrigerators with stainless steel wire shelves suitable for general laboratory storage.
4. Electrical: 115 VAC. 60Hz plug-in cord, minimum 8' long. All connections shall comply with the local electrical codes.
5. Refrigerator / Freezer Schedule:

Equip. Number	Type	Model Number	Size Cubic Feet	Operating Range ºC
R2	Lab Refrigerator / Freezer	Thermo Scientific / TSV18CPSA	18	+1° to +12° -24º to -12º
F1	Lab Freezer	Thermo Scientific / TSV20FPSA	21	-24º to -12º

D. PCR Enclosure (Equipment Number **FB18**): Ductless PCR Enclosure by Labconco, www.labconco.com or equal product pre-approved in writing prior to General Contractor bid submission:

1. Model 3980303 Purifier Filtered PCR Enclosure:
   a. Dimensions (External): 36"W x 28.6"D x 36.8"H
   b. Air Volume: 165-230 CFM
2. Materials: UV-resistant, glacier white and gray, powder coated aluminum and steel construction
3. Glass: UV-opaque and resistant ¼" thick tempered safety glass sash and sides
4. Work Surface: Solid epoxy resin, dished

5. Sash opening: 9.4” high
6. Nominal downflow velocity: 45-65 fpm
7. Filter types: HEPA, 99.9% efficient on particles 0.3 micron; Disposable pre-filter
8. Electrical requirements: 115V, 15A
9. Features:
    a. Adjustable height base stand
    b. Aerodynamic airfoil
    c. ISO Class 5 air
    d. Minihelic pressure gauge
    e. Air diffuser
    f. Variable speed built-in blower
    g. Two utility ports with iris openings and plugs
    h. Variable digital timer for UV exposure with 8 settings in minutes of 5, 10, 15, 30, 60, 120, 240 and continuous
    i. UV lamp with interlocked UV protection panel
    j. Air diffuser

E. Safety Supply Cabinet (Equipment Number **SSC**):
1. Basis of Design: Acudor. Products of Karp or Best Access Doors are acceptable, provided they comply with features listed below, will be considered acceptable.
2. Model: Customized version of ARVB Recessed Valve Box
3. Features:
    a. Size: Inside box dimensions: 12”W x 18”H x 4”D
    b. Style: Fully recessed, with overlapping trim, door flush with trim, one adjustable shelf.
    c. Single flat door:
        1) Door material: Solid panel, stainless steel, #4 Satin Polish finish.
        2) Door Handle: Flush mounted paddle handle without lock, finished to match door.
        3) Hinge: Concealed piano hinge, heavy duty stainless steel.
    d. Trim:
        1) Material and Finish: Same as door, arc welded and ground smooth.
    e. Signage: Provide self-adhesive signage in compliance with ANSI Z-535 on each door with the message “First Aid Station”, the universal First Aid cross and heading “Emergency” in the color “Safety Green and White”, from Grainger, model number LFSD903VSP, www.grainger.com.
    f. Box Interior Finish: Stainless steel sheet, #4 Satin Polish finish
    g. Provide 1/4” diameter holds inside box on 4 sides for mounting in laboratory casework.
    h. Install one first aid kit and one burn kit in each safety supply cabinet.
    i. Quantity of safety supply cabinets: At locations shown in the drawings.

j. Shelf: Provide 1 shelf, centered.

F. First Aid Kit (Inside Safety Supply Cabinet):
1. Manufacturer: Johnson & Johnson, or equivalent products of Grainger
2. Product: Small Industrial First Aid Kit
3. Product Number: 39N794
4. Supplier: Grainger, 800-356-0783, website: www.grainger.com
5. Size: 6-1/2"H x 9-1/2"W x 2-3/4"D, or as required to fit into the safety cabinet

G. Burn Kit (Inside Safety Supply Cabinet)
1. Manufacturer: WaterJel FSK-5, or equivalent products of Grainger
2. Product: Emergency Burn Kit
3. Product Number: 9RTV3
4. Supplier: Grainger, 800-356-0783, website: www.grainger.com
5. Size: 7.25"H x 9.9"W x 3"D, or as required to fit into the safety cabinet

H. Laboratory Coat Hook Strips (Equipment Numbers **CH1,CH3**):
1. Manufacturer: Bradley Corporation, or equal products by America Specialties or AJW Architectural Products
2. Single Prong Accessible Coat Hook (**CH1**): Model No. 9134
   a. Satin finish stainless steel
   b. Surface mount at 48" AFF to hook, to meet local accessibility requirements
   c. Quantity/Size: Where shown on drawings
3. Coat Hook Strips: Model No. 9944, 36"L (**CH3**)
   a. Stainless steel with bright polish finish
   b. Mount at 60" AFF to hook
   c. Quantity/size: where shown on drawings (3 hook = 24")

I. Lab Coat Racks & Shelf (Equipment Number **CR**): Wall mounted, adjustable elevation coat rack with clothing rod.
1. Manufacturer: Magnuson Group
2. Model: Architectural series WHO2-A
3. Finish:
   a. Shelf Tubes: Aluminum
   b. Brackets: Medium Gray
   c. Wall Mount: Medium Gray
   d. Hanger Rod: 1"Ø Charcoal Gray with Chrome Hooks
4. Provide each coat rack with (12) MG17PH hangars
5. Mounting Height: 48" AFF for accessible height, adjustable to 60" AFF

J. Laboratory Spill Cart (Equipment Number **SC**):
1. Supplier: Grainger, 800-356-0783, website: www.grainger.com
2. Model No.: 2NCP2, 22 gal wheeled cart

3. Size: 39”H x 18”W x 17”L
4. Fully stocked with:
    a. (1) SPC MRO 15-DPS Universal Absorbent
    b. (5) 3" x 4 ft. Socks
    c. (8) 8-1/2" x 9-1/2" Pillows
    d. (1) Pair of Goggles
    e. (1) Pair of Nitrile Gloves
    f. (5) Disposal Bags
    g. Emergency Handbook
5. Quantity: Where shown on drawings

K. Laboratory Paper Towel Dispenser (Equipment Number **PTD**):
1. Manufacturer: Bobrick Washroom Equipment, or equal products by American Specialties, or Bradley Corporation
2. Model: B-262, ClassicSeries®
3. Material: Stainless steel
4. Finish: Satin
5. Size: 10-3/4”w x 14”h x 4”d
6. Mounting Type: Wall Surface
7. Quantity: Where shown on drawings

L. Deionized Water Polisher (Type 1 & Type 3 water) (Equipment Number **WP1**): WaterPro BT Water Purification System wall or counter mounted dispenser by Labconco, 8811 Prospect Avenue, Kansas City, Missouri, (816) 333-8811, or approved equal prior to bid submission.
1. Produce ultrapure 18-Meg Ohm water per the quantitative specification for Type 1 and 1-Meg Ohm water per the quantitative specification for Type III water as described in ISO 3696, ASTM D1193, and of EP and USP Purified Water.
2. System to be counter or wall mounted.
3. Connect to 1/2” diameter house water source.
4. Provide remote dispenser.
6. Delivery flow rate of >.5L/min
7. Production rate of 3L/hr.
8. One year warranty.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify equipment rough-in before proceeding with the work in this Section.

B. Coordinate with other trades for the proper and correct installation of plumbing and electrical rough-in, structural backing for items attached to walls and ceilings and for rough opening dimensions required for the installation of products in this Section.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with standards required by authorities having jurisdiction.

C. Anchor equipment securely in place.

D. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

E. Touch-up minor damaged surfaces caused during installation. Replace damaged components as directed by Architect.

F. Equipment in this Section shall be installed by the equipment subcontractor with all necessary fittings mounted for final connection by Divisions 23 and 26.

G. Fixtures and accessories supplied and/or installed as a portion of the work shall be installed in a precise manner in accordance with manufacturer's directions. Where connections are required to electrical lines, the manufacturer is to provide items required for connection and coordinate the final installation made by the other Contractors.

3.3 CLEANING, ADJUSTING & PROTECTION

A. Repair or remove and replace defective work as directed upon completion of installation.

B. Clean shop finished surfaces, touch-up as required and remove or refinish damaged or soiled areas, as acceptable to Architect.

C. Protection: Advise Contractor of procedures and precautions of protection of materials and installed laboratory furniture form damage by work of other trades.

D. Adjust operating equipment to efficient operation for its intended use and as required by the manufacturer.

3.4 DEMONSTRATION

A. Provide systems training and demonstration of all equipment operations and functions.

B. Refer to Commissioning Specification Section for training requirements for specific systems and equipment. Training of the Owner's operation and maintenance personnel is required in cooperation with the Commissioning Consultant. A training agenda shall be prepared by the Contractor and approved by the Owner prior to training performance.

END OF SECTION 11 53 00

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SECTION 11 53 13

LABORATORY FUME HOODS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. Furnish all laboratory chemical fume hoods, lab service fittings and miscellaneous items of equipment in these specifications or equipment schedules including delivery to the building, setting in place, leveling and scribing to walls and floors as required. Divisions 22, 23 and 26 shall be responsible for final connections of the laboratory fume hoods and accessories specified herein.

2. Furnishing and delivery of all utility service outlet accessory fittings as listed in these specifications, equipment schedules or as indicated by drawings as mounted on the laboratory furniture. The above-defined items shall be furnished assembled with supply tank nipples and lock nuts, not attached, loose in boxes and properly marked for delivery to the mechanical contractor (except for pre-wired or pre-plumbed items such as fume hoods, which are to be delivered completely assembled). All plumbing and electrical fittings will be packaged separately and properly marked for delivery to the appropriate contractor.

3. Furnishing and delivering, packed in boxes for installation by the contractor, all drains, drain troughs, overflows and sink outlets with integral tailpieces, which occur above the floor, and where these items are part of the equipment or listing in the specifications, equipment schedules or indicated by the drawings. Integral tailpieces, when required, shall be in accordance with the manufacturer's standards. All tailpieces shall be furnished less the couplings required to connect them to the drain piping system.

4. Furnishing service strip supports where specified, and setting in place service tunnels, service turrets, supporting structures and reagent racks of the type indicated by the details.

B. Work Not Included in this Sections

1. Equipment, materials and labor which are the responsibility of other subcontractors, as determined by the General Contractor may include the following:

a. Electrical receptacles, except where integral to the fume hood.

b. Furnishing, installing and connecting of ducts from fume hood's duct collar to fans and from fans to the atmosphere.

c. Furnishing, installing and connecting of fume hood fans.

1.2 RELATED DOCUMENTS: The completion of the work described in this Section may require work in or coordination with other Sections of these specifications. The Contractor and the subcontractor will be responsible for identifying and including all related work in other Sections of these specifications and / or drawings necessary for a complete installation of the work described in this Section. These related sections include, but are not limited to the following:

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

B. Commissioning: Division 1

C. Refer to Divisions 23 and 26 and the Mechanical and Electrical drawings for related mechanical and electrical work.

D. Division 5 & 6: Blocking and backing in walls for anchorage of fume hoods

E. Division 23: Laboratory Temperature and Airflow Control System

F. Division 23: Control Instrumentation

G. Division 23: Air Valves

H. Division 23: Direct Digital Control System

I. Division 23: Control & Automation Material

J. Division 23: Sequence of Operation

K. Division 26: Electrical Fittings and Connections

L. System commissioning is a part of the construction process. Documentation and testing of systems, as well as training of the Owner's operation and maintenance personnel, is required in cooperation with the Commissioning Consultant. Substantial Completion is dependent on successful completion of all commissioning procedures, documentation and issue closure. Refer to Commissioning Specification Section for detailed commissioning requirements.

1.3 REFERENCES

A. SAMA LF10-80, Laboratory Fume Hoods

B. NFPA 45, Fire Protection for Laboratories Using Chemicals

C. ASTM E-84-98, Surface-burning Characteristics of Building Materials

D. ASHRAE 110-2016, Method of Testing Performance of Laboratory Fume Hoods (Factory Testing)

E. ANSI/AIHA Z9.5-1992, Laboratory Ventilation

F. AIHA 147 EQ 91, AIHA 148 EQ 91, Industrial Ventilation Workbook

G. ACGIH Pub. 9322, Laboratory Fume Hoods

H. ACHIH Pub. 2092, Industrial Ventilation

I. SEFA LF1-1996, Laboratory Fume Hoods & Field Testing of Fume Hoods

J. OSHA 29CFR 1910.1000, Fume Hood Face Velocity

K. UL – Underwriter's Laboratories, Inc.

L. SEFA 1.2, Laboratory Fume Hoods

M. UL – Underwriter's Laboratories, Inc, 1805, Laboratory Fume Hoods

N. DOE US Green Building Council – LEED II

1.4 SUBMITTALS

A. Submit under provisions of Division 1, General Requirements.

B. Shop Drawings: Provide digital reproducible set, 1/2"=1'-0" scale elevations and 1/4"=1'-0" plans of fume hoods locations, showing cross sections, details, rough-in and anchor placement dimensions and tolerances and clearances required. Indicate relation to surrounding walls, ceiling, windows, doors and other building components. Show rough-in requirements. Show locations of all required framing, bucks, metal grounds or reinforcements in walls, floors and ceilings to adequately support the fume hoods and for proper anchoring and support.

C. Product Data: Provide manufacturer's technical data for each component and item of fume hood specified, including dimensions and construction, configurations, color selection charts, attachment and anchorage details, equipment capacities, physical dimensions, construction details, utility and service requirements and locations, point loads and factory finishes.

1. Manufacturer's Installation Instruction: Indicate special installation requirements.

2. Seismic Restraints: The fume hood manufacturer / installer shall install the fume hoods to resist seismic loading as required by the local governing codes. Provide all seismic details with fume hood submittals indicating required wall construction, such as wall stud gauge and size, point loads, etc. install all anchorage devices, including special legs and / or braces required for seismic restraint of fume hoods and accessories to satisfy all governing code requirements for seismic anchorage of equipment.

3. Instruction: Submit for review and approval written approval instructions in booklet form providing additional details on safe operation and maintenance.

D. Samples: Provide the following samples:

1. Finish Samples: Submit samples of each color of finish for fume hoods and other prefinished work as well as accessories for selection by interior designer.

E. Test Data & Reports: Submit test reports on each size and type of hood, verifying conformance to test performance specified. This information shall be spiral bound in a separate document submitted with the other operational and maintenance documents. Test report must accompany each hood as part of installation and usage package.

1. Submit independent factory test reports in accordance with ASHRAE 110-95 and field-testing in accordance with SEFA LF1-1998. The minimum overall performance rating of each test shall be 4.0 AM 0.05 with 4.0 liters per minute of tracer gas release, AM identifying a “as manufacturer” test, and 0.05 indicating the level of tracer gas control in parts per million.

2. Submit detailed seismic anchorage and attachment drawings and calculations provided by a licensed structural engineer, licensed in the state of the project, complying with all building code requirements and regulations for seismic restraint.

F. Instructions: Submit for review and approval:

1. Instructions to be inscribed on instruction plate to be attached to hood, as specified in Part 2 of this section.

2. Written instructions in booklet form providing additional details on safe and proper operation and maintenance of fume hoods.

3. Testing procedures to be used in the factory and field-testing of fume hoods.

G. Mock Up: On site review prior to primary installation:

1. Install fume hood and fittings in an Architect selected smaller representative lab area prior to installing the bulk of fume hoods throughout the project and request review.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit information in bound manual form, on 8-1/2” x 11” paper.

B. Operation Data: Include description of required operation, adjusting and testing.

C. Maintenance Data: Identify system maintenance requirements, servicing cycles and spare part sources.

1.6 QUALITY ASSURANCE

A. Single source responsibility: Laboratory furniture system, casework, work surfaces, fume hoods, laboratory equipment and accessories shall be manufactured or finished by a single laboratory furniture company.

B. Manufacturer’s Qualifications: Modern plant with proper tools, dies, fixtures and skilled workmen to produce high quality laboratory equipment. Installers shall be factory certified by the manufacturers.

C. Coordination Drawings: The supplier / installer shall coordinate the installation of all products under the section, including mechanical and electrical items, which are provided by the supplier and installed by other contractors. Laboratory fume hood manufacturer shall be responsible for generating layout drawings and distributing them to the mechanical and electrical contractors for coordination and accurate locations of cutouts and service connections required by each discipline, prior to generating final shop drawings.

D. Owner has the right to inspect equipment at the manufacturer's factory prior to shipment. Equipment found not to be in conformance with requirements of the Contract Documents might be rejected.

E. Installer's qualifications: Installer shall be factory certified by the manufacturer.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products on the site in such a manner as to minimize the risk of damage, decay, deterioration or loss from theft.

B. All products shall be delivered to the job site in manufacturer's original unopened containers, crates or protective wrappings with the manufacturer's name and addressed clearly labeled thereon.

C. Accept products on site and inspect on arrival for damage.

D. Protect product from damage of soiling at all times. Keep products covered with polyethylene film or other suitable protective coverings. Protect installed casework throughout construction period with corrugated cardboard completely covering the top and securely taped to edges. Mark cardboard in large lettering "No Standing".

1.8 PROJECT CONDITIONS

A. Do not deliver or install fume hoods in the final work until building is secure and weather-tight, all painting is completed, and ceilings, overhead ductwork and lighting are installed and HVAC systems are operational and capable of maintaining the building temperature and humidity at occupancy levels throughout the remainder of the construction period.

1.9 FIELD MEASUREMENTS

A. Verify field measurements shown on shop drawings or as instructed by manufacturer.

1.10 WARRANTY

A. Provide warranty under provisions of Division 1.

1.11 EXTRA STOCK / SPARE PARTS

A. Provide the following spare parts delivered to the Owner in unopened boxes:

1. One safety monitor and all associated wiring components.

PART 2 - PRODUCTS

2.1 ACCEPTABLE PRODUCTS

A. Fume Hood General Design Requirements:

1. Approved Fume hood manufacturers and products include:

a. Jamestown Metal Products: Isolator Gen5 Series (Basis of Design)

b. Kewaunee Scientific: Supreme Air Venturi Series

c. Mott Manufacturing: Safeguard Series

d. Labconco: Protector XStream Series

e. Products by other manufacturers submitted as equals will be reviewed for conformance with the specifications only if submitted and pre-approved in writing prior to bid submission.

2. Intent and Function: Fume hoods shall function as ventilated, enclosed workspaces, designed to capture, confine and exhaust chemical fumes, vapors and particulate matter produced or generated within the enclosure. Fume hoods shall be designed for consistent and safe airflow through the hood face. Negative variations of face velocity shall not exceed 20% of the average face velocity at any designated measuring point as defined in this section.

3. Work Area: Work area shall be defined as the area inside the superstructure from side to side and from face of baffle to the inside face of the sash, and from the working surface to a height of 28".

4. Illumination: Average illumination or work area shall be minimum 80 foot-candles at the fume hood work surface.

5. Fume hood shall be designed to minimize static pressure loss with adequate slot area and bell shaped exhaust collar configuration. Maximum average static pressure loss readings taken three diameters above the hood outlet from four points, 90 degrees apart, shall not exceed 0.5 inches wg with the following sash opening in the full open position as follows:

   Face Velocity – 18" sash opening

   80-100 FPM (with 80 FPM set point)

6. Static pressures and fume hood entry CFM are as given for each fume hood in the fume hood manufacturer's product specifications / literature.

7. Constant Air Volume Fume Hoods (CAV):

   a. Fume hoods shall be constant air volume fume hood designed to yield 80 FPM face velocity at 18" sash opening.

   b. Notched belt and sprocket sash system

   c. Electronic sash stop at 18"

   d. LED lighting, with variable intensity and color range

   e. Unobstructed viewing height to be minimum 38.5"

Rising Sash	CFM @ 18" Opening
f. 4-feet	
1) Jamestown Metal Products	475
2) Kewaunee	430-515
3) Mott	385-481
4) Labconco	350-440

8. **ADA compliant fume hoods: Provide the manufacturer's standard ADA compliant fume hood where ADA hoods are indicated in the drawings. Specific requirements for ADA hoods, above and beyond the standard hood specification, are indicated in brackets [ ], italicized and noted 'Special ADA Requirement'. ADA Compliant hoods are designated in the drawings with 'ADA'.**

9. Noise criteria: Test data of octave band analysis verifying hood is capable of a 40 NC value when connected to a 40 NC HVAC source. Reading taken 3' in front of open sash at 110 fpm face velocity.
10. UL Label: Provide all units with approved UL 1805 labels or provide UL certification in field. All hoods must be UL certified and labeled as such. (UL 1805 is now the standard for fume hood certification. UL 1805 covers not just electrical, but construction and airflow standards for fume hoods.)

B. Fume Hood Liner Surface Finish Performance Requirements
1. Liners shall conform to physical properties and test results in accordance with the testing procedures described below.
2. Fume hood liners per fume hood schedule:
   a. KEMGLASS Fiberglass Reinforced Polyester Lining: Interior liner panels shall be 1/4" thick white fiberglass reinforced polyester sheet. Interior liner panels shall be fastened using stainless steel screws with plastic covered heads.
3. Test Procedure No. 1 – Spills and Splashes (Factory Test):
   a. Suspend in a vertical plane a 42" (horizontal) by 12" (vertical) panel divided into 3/4" wide vertical columns, each column numbered 1 through 49.
   b. Apply five drops of each reagent listed with an eye dropper.
   c. Apply liquid reagents at top of panel and allow to flow down full panel height. (CAUTION! Flush away any reagent drops)
4. Test Procedure No. 2 – Fumes and Gases:
   a. Divide 24" x 12" panel into 2" squares, each square numbered 1 through 49.
   b. Place 24 milliliters of reagent into 100-milliliter beakers and position panel over beaker tops in the proper sequence. Note: Beaker pouring lip permits atmospheric oxygen to enter and participate in the reaction of the reagent fumes.
5. After 24 hours, remove panel, flush with water, clean with naphtha and detergent, rinse, wipe dry and evaluate.
6. Evaluation ratings: Change in surface finish and function shall be described by the following ratings:
   a. No Effect: No detectable change in surface material.
   b. Excellent: Slight detectable change in color or gloss, but no change to the function or life of the work surface material.
   c. Good: Clearly discernible change in color or gloss, but no significant impairment of work surface function or life.
   d. Fair: Objectionable change in appearance due to surface discoloration or etch, possibly resulting in deterioration of function over an extended period.
   e. Failure: Pitting, cratering or erosion of work surface material; obvious and significant deterioration.
7. Test Results: Polyresin Fume Hood Liner
   a. Test Procedure:
      1) Test No. 1 – Spills and Splashes:
         a) Suspend in a vertical plane a 42" (horizontal) by 12" (vertical) panel divided into 3/4" wide vertical columns, each column numbered 1 through 49.

b) Apply five drops of each reagent listed with an eye dropper.

c) Apply liquid reagents at top of panel and allow to flow down full panel height. (CAUTION! Flush away any reagent drops.)

2) Test No. 2 – Fumes and Gases:

a) Divide 24" x 12" panel into 2" squares, each square numbered 1 through 49.

b) Place 25 milliliters of reagent into 100 milliliter beakers and position panel over beaker tops in the proper sequence. Note: Beaker pouring lip permits atmospheric oxygen to enter and participate in the reaction of the reagent fumes.

3) After 24 hours, remove panel, flush with water, clean with naphtha and detergent, rinse, wipe dry and evaluate.

b. Evaluation Ratings: Change in surface finish and function shall be described by the following ratings:

1) No Effect: No detectable change in surface material.

2) Excellent: Slight detectable change in color or gloss, but no change to the function or life of the work surface material.

3) Good: Clearly discernible change in color or gloss, but no significant impairment of work surface function or life.

4) Fair: Objectionable change in appearance due to surface discoloration or etch, possibly resulting in deterioration of function over an extended period.

5) Failure: Pitting, cratering or erosion of work surface material; obvious and significant deterioration.

c. Test Results: Polyresin Fume Hood Liner

	REAGENT LIST Concentrations by Weight	Test No. 1 Rating Spills	Test No. 2 Fumes
1)	Sodium Hydroxide Flake	---	No Effect
2)	Sodium Hydroxide, 40%	Excellent	No Effect
3)	Sodium Hydroxide, 20%	Excellent	No Effect
4)	Sodium Hydroxide, 10%	Excellent	No Effect
5)	Ammonium Hydroxide, 28%	No Effect	No Effect
6)	Eldorado – Plus (Solution)	No Effect	No Effect
7)	Chloroform	Excellent	No Effect
8)	LpH SE (Solution)	No Effect	No Effect
9)	Trichloroethylene	Excellent	No Effect
10)	Monochlorobenzene	Excellent	No Effect
11)	Tincture of Iodine	Excellent	Excellent
12)	Methyl Alcohol	No Effect	No Effect
13)	Ethyl Alcohol	No Effect	No Effect
14)	Butyl Alcohol	No Effect	No Effect
15)	Phenol, 85%	Excellent	No Effect

16)	Cresol	Excellent	No Effect
17)	Sodium Sulfide, Saturated	Good	No Effect
18)	Furfural	Fair	No Effect
19)	Dioxane	No Effect	No Effect
20)	Zinc Chloride, Saturated	No Effect	No Effect
21)	Benzene	Excellent	No Effect
22)	Toluene	Excellent	No Effect
23)	Xylene	Excellent	No Effect
24)	Gasoline	Excellent	No Effect
25)	Naphthalene	Excellent	No Effect
26)	Methyl Ethyl Ketone	Excellent	No Effect
27)	Acetone	Excellent	No Effect
28)	Ethyl Acetate	Excellent	No Effect
29)	Amyl Acetate	Excellent	No Effect
30)	Ethyl Ether	Excellent	No Effect
31)	Silver Nitrate, 10%	Good	No Effect
32)	Dimethylformamide	No Effect	Excellent
33)	Formaldehyde	No Effect	No Effect
34)	Formic Acid, 88%	No Effect	No Effect
35)	Acetic Acid, Glacial	No Effect	No Effect
36)	Dichloroacetic Acid, 93%	Excellent	Excellent
37)	Chromic Acid, Saturated	Good	No Effect
38)	Phosphoric Acid, 85%	No Effect	No Effect
39)	Sulfuric Acid, 33%	No Effect	No Effect
40)	Sulfuric Acid, 77%	Excellent	No Effect
41)	Sulfuric Acid, 93%	Good	No Effect
42)	Hydrogen Peroxide, 30%	No Effect	No Effect
43)	Acid Dichromate	Excellent	No Effect
44)	Nitric Acid, 20%	Excellent	No Effect
45)	Nitric Acid, 30%	Excellent	No Effect
46)	40 & 47 Equal Parts	Excellent	Good
47)	Nitric Acid, 70%	Excellent	Good
48)	Hydrochloric Acid, 37%	No Effect	Excellent
49)	Hydrofluoric Acid, 48%	No Effect	Failure

8. Physical Properties:

a. Reinforced polyester panels and epoxy resin, smooth finish and white color in final appearance.

b. Flexural Strength: 14,000 psi

c. Flame Spread: 6 or less per UL 723 and ASTM E84-80

C. Fume Hood Materials:

1. Steel: High quality, cold rolled, mild steel meeting requirements of ASTM A-366; gauges US Standard
2. Ceiling closure panels: Minimum 18 gauge, finish to match hood exterior
3. Bypass Grilles: Low resistance type, 18 gauge steel, upward directional louvers
4. Safety Glass: 7/32" thick laminated safety glass
5. Sash Belt: Notched belt
6. Sash Guides: Corrosion resistant polyvinyl chloride
7. Pulley assembly for sash cable: 2" diameter, zinc dichromate finish, ball bearing type, with cable retaining device
8. Sash Pull: Full width corrosion resistant steel with chemical resistant powder coating with stainless steel pulls integrated into spoiler shaped sash foil.
9. Gaskets: 70 durometer PVC for interior access panels. Gasket interior access panels to eliminate air leakage and to retain liquids inside hood
10. Fastenings:
    a. Exterior structural member's attachments: Sheet metal screws, zinc plated
    b. Interior fastening devices: Concealed. Exposed screws not acceptable
    c. Exterior panel member fastening devices: Concealed corrosion resistance non-metallic material. Exposed screws not acceptable
11. Instruction plate: Corrosion resistant or plastic plate attached to the fume hood exterior with condensed information covering recommended locations for apparatus and accessories, baffle settings and use of sash.

D. Fume Hood Construction:

1. Superstructure: Rigid, self-supporting assembly of double wall construction, maximum 4.5" wide.
    a. Wall shall consist of an 18 gauge sheet steel outer shell and a corrosion resistant inner liner, and shall house and conceal steel framing members, attaching brackets and remote operating service fixture mechanisms and services. Panels must be attached to a full frame construction, minimum 14 gauge galvanized members. Panels and brackets attached to eliminate screw heads and metallic bracketry from hood interior.
    b. Access to fixture valves concealed in wall provided by exterior removable access panels, gasketed access panels on the inside liner walls, or through removable front posts.
    c. Supporting frames: Where cabinets are scheduled beneath fume hoods, fume hood shall rest on and be anchored to base cabinetry designed to support the fume hoods. Where cabinets are not scheduled beneath fume hoods, provide the manufacturer's standard tubular steel table frame with apron panel designed to support fume hoods, and provide unencumbered knee space beneath hoods. Fume hoods identified as ADA to have ADA compliant apron depth.

2. Ceiling Skirt Enclosures: Provide ceiling skirt enclosure panels from top of hood extending up to the ceiling, terminating 1" below ceiling system. Provide an access panel in the ceiling enclosure, located below the ceiling, with thumbscrews to permit easy of accessibility to the space above the fume hood for maintenance purposes.
3. Seismic Restraints: The hood manufacturer shall provide with the hoods all anchorage devices, including special legs and/or braces, for seismic restraint of hood to satisfy all governing code requirements for seismic anchorage of equipment. Provide all seismic details with hood submittals indicating required wall construction such as wall stud size and gauge, point loads, etc.
4. Color: All painted surfaces, including ceiling enclosures, shall be provided from manufacturer's standard colors as selected by the Architect.
5. Exhaust Outlet:
    a. Rectangular with ends radiused, bell shaped and flanged, 18 gauge 304 stainless steel exhaust collars welded in place.
    b. Fume hood manufacturer shall provide and install a rectangular to round stainless steel transition duct between the top of the fume hood and the exhaust duct. Coordinate outlet size(s) with ductwork installer. Connection of the exhaust duct to the fume hood transition piece shall be by the ductwork installer.
6. Access opening perimeter: Air foil or streamlined shape with all right angle corners radiused or angled. Bottom horizontal foil shall provide nominal one-inch bypass when sash is in the closed position. Bottom foil shall be removable without use of special tools. Bottom foil shall provide access areas for electrical cords. Bottom foil: 316 Stainless steel to increase acid and abrasion resistance. Air foil and sill to extend no more than 1.5" in front of work surface to provide maximum aisle space and allow deeper usage.
7. Fume Hood Sash and Special Controls:
    a. Sash at all fume hoods, except ADA fume hoods, shall be full view type, vertical rising sash with clear, unobstructed, side to side view of fume hood interior and service fixture connections.
    b. Bottom sash rail: 2" maximum, 18 gauge steel with powder coating finish. Provide integral formed, flush pull the full width of bottom rail.
    c. Laminated Safety Glass: Set safety glass into rails in deep form, extruded polyvinyl chloride or neoprene glazing channels. Tempered or float glass not accepted.
    d. Counter balance system: The sash shall be counterbalanced with a single weight to prevent titling and binding during operations. The sash shall be connected to the counterweight system with two (2), ½" wide steel-reinforced polyurethane notched belts that engage two (2) sprocket shaft drives. Design system to hold sash at any position without creep and to prevent sash drop in the event of cable failure. Maximum 7 pounds pull required to raise or lower sash throughout its full length of travel. The sash shall provide a 38.5" viewing height, with a maximum opening of 28"
    e. Open and close sash against rubber bumper stops. Sash shall lock into place with manual override.
    f. Align top of the bottom sash rail flush with the hood interior work surface in closed position. Construct sash frame in a manner that will not require user to reach over the sash frame.
    g. Fume Hood Sash Position Sensors or face velocity sensors: Sash position sensors or face velocity sensors are specified in Division 23. The fume hood manufacturer shall

provide the appropriately sized cutout in the correct location to accept the sensors and monitor. Sash or face velocity sensors shall be provided as specified in Division 23.

Manufacturer and the Division 23 subcontractor shall coordinate all installation requirements, interfaces and wiring with Division 23.

8. Safety Monitor / Alarm System (which monitors and displays face velocity and provides audible and visual alarm if face velocity drops below 75 FPM or rises above 125 fpm):

   a. Furnished by Division 23. The fume hood manufacturer, Division 23 contractor and controls contractor shall coordinate all installation requirements, interfaces and wiring.

   b. Division 23 to provide vertical sash alarm system, which monitors vertical sash travel. Raising of sash above the sash stop position, shall trigger audible and visual signal. The fume hood sash monitor/alarm system shall also be interfaced with the building energy management controls system to avoid going into the alarm mode during the unoccupied mode.

   c. Calibration: Calibration is required following hood installation and balancing of all HVAC systems, supply and exhaust. (Secondary calibration has been factory set into the alarm's memory only to determine that the alarm is functional and ready for shipment.) Balancing of exhaust system and fume hoods is by Division 23 contractor.

   d. Alarm signal: Refer to Division 23. (System which permits users to routinely or easily reset alarm signal points or turn off power to the unit is not acceptable.)

   e. Test circuit shall be provided to verify proper Safety Monitor operation.

   f. Electrical rating: Maximum 12 VDC, and a maximum current rating of 200 MA.

   g. Low flow alarm at unoccupied mode: The fume hood shall be provided with the necessary provisions to be tied to the Owner's energy management system with the capability of automatically disabling the low flow alarm during the unoccupied mode.

   h. Battery pack: Provide battery pack to supply power to the Safety Monitor for 24 hours in the event of an electrical power failure.

   [Special ADA requirement: Alarms shall consist of silence switch to deactivate audible, located to be reachable by able bodied and handicapped individuals.]

9. Automatic Sash Closer: Auto sash return provides an automatic sash return that lowers the sash to 18" from the full-open set-up position. When the sash is raised to the full open position, a sash lock holds the sash open for set-up purposes. By pressing the electronic sash stop release button, the sash automatically closes to the 18" operating height.

10. Automatic Sash Operator/Occupancy Sensors:

    a. Description: The Automatic Sash Operator shall close the sash of a fume hood slowly and safely when the fume hood is not actively being used by laboratory personnel. A motion sensor, mounted in the top front panel of the fume hood shall monitor movement in front of the hood. When no movement is detected within a programmable amount of time, the sash shall automatically close. When personnel are present, the sash shall be able to be opened and closed manually.

       In addition to the motion sensor, a photoelectric sensor placed on the sash creates a light beam, which scans the sash area for obstructions in the path of the sash. When an obstruction exists, the sash shall halt its descent, and a warning light shall signal that an obstruction exists. Once the obstruction is removed, the Sash Operator warning light shall reset, and the unit reengage.

       The Automatic Sash Operator shall be factory installed on the fume hood with all

required mechanical connections to the sash shaft for proper operation, and prewired to a junction box located on the top of the hood.

b. Controller: The Automatic Sash Operator shall include a microprocessor controller programmed to close the sash after a set time when no motion in the fume hood operator area is detected, and no obstruction in the sash plane exists. Controller shall be user programmable from 0 to 9999 seconds.

c. Drive Motor: The Automatic Sash Operator shall include a gear motor, coupled by chain and sprocket to the sash drive shaft. The motor shall be capable of closing the sash throughout the full range of motion. The motor shall be internally overload protected, and UL and CE approved.

d. Operator Presence Sensor: The Operator Presence Sensor shall be an active infrared sensor with a detection range of nine (9) feet and an operating temperature range of -4 degrees F to 131 degrees F.

11. Pre-wired Fume Hoods:

    a. All electrical components and controls components within the fume hood shall be pre-wired to a junction box located within the top of the hood, allowing for single connections to the power or controls source, by Division 26. Extend prewired components 8” above the fume hood.

12. Acid storage cabinet bypass ventilation: Fume hoods shall include a vent riser, provided and installed by the fume hood manufacturer, located between the sidewall liner and the exterior face of the superstructure for the purpose of venting the acid storage base cabinets. Vent risers shall extend from the base cabinet to the exhaust duct above the fume hood. Material and size of vent riser shall be determined by the fume hood manufacturer, and shall be in compliance with applicable reference standards, codes and regulations. Connections of the vent riser to the base cabinet shall be by the fume hood installer. Connection to the duct above the fume hood shall be by the mechanical contractor. Venting shall provide for approximately 10 air changes per hour in each unit.

13. Baffles: Baffles providing controlled air vectors into and through the fume hood shall be fabricated of the same material as the liner. Provide exhaust slots full height on vertical sides of the baffle with upper and lower slots adjustable. Provide fixed, permanently open horizontal slot 17" above the work surface. Minimum height of 19" for interior workspace is required at the extreme upper portion of the fume hood to provide maximum interior work area. All baffle support brackets to be non-metallic.

14. Tissue Screen: Provide perforated stainless steel screen, consisting of a stainless steel wire mesh. Locate screen at back baffle area to prevent small evidential articles from being swept up into the exhaust system.

15. Fume Hood Lighting: An LED light fixture of the size given below shall be provided in the hood roof. The light shall provide intensity adjustment levels.

    a. Illumination at the worksurface shall be at 100 foot-candles at the full intensity setting.

    b. The light fixture shall be isolated from the hood interior by a 1/4" thick tempered glass panel sealed from the hood cavity.

    c. Fixture shall be UL listed.

    Special ADA requirement: Switch reachable by both an able bodied as well as wheel chair bound individual.

16. Electrical Services: Three wire grounding type GFI receptacles rated at 120 VAC at 20 amperes, gray acid resistant thermoplastic. Flush plates: Type 304 stainless steel.

    Provide two factory installed duplex outlets per hood, one on each post outside of fume hood cavity. All electrical devices provided by fume hood manufacturer shall be by the same manufacturer as provided by the Electrical Contractor. Fume hoods shall be prewired to top of hood.

17. Work Surfaces in Fume Hoods: All worksurfaces to be 24" deep unless noted otherwise on fume hood schedule. Worksurface material to be epoxy resin unless noted otherwise on fume hood schedule.

    a. Epoxy Resin: To match adjacent laboratory counter top color. 1-1/4" thick surface, dished a nominal one-half inch to contain spills. Front raised no more than 1/2". Worktops to incorporate a secondary trough flush with work surface to allow for additional spill containment not secured by dished work surface alone.

E. Metal Finish: Finish performance requirements shall be the same as previously specified for painted steel casework.

1. Preparation: Spray clean metal with a heated cleaner/phosphate solution, pretreat with iron phosphate spray, water rinse, and neutral final seal. Immediately dry in heated ovens, gradually cooled, prior to application of finish.

2. Application: Electrostatically apply powder coat of selected and bake in controlled high temperature oven to assure a smooth, hard satin finish. Surfaces shall have a chemical resistant, high-grade laboratory furniture quality finish of the following thickness:

    a. Exterior and interior surfaces exposed to view: 1.5 mil average and 1.2 mil minimum.

    b. Backs of cabinets and other surfaces not exposed to view: 1.0 mil average.

3. Color: Color of fume hood and ceiling enclosures shall be selected by architect from manufacturer's standard line of colors.

F. Quality Control Testing of Fume Hood Performance (Factory & Field Testing):

1. Factory Testing: Evaluation of manufacturer's standard product shall take place in manufacturer's own test facility, with testing personnel, samples, apparatus, instruments, and test materials supplied by the manufacturer at no cost to the Owner. Perform factory testing in accordance with ASHRAE 110-95.

2. Submit test report consisting of the following test parameters and equipment for each hood width and configuration specified.

3. Hood shall achieve a rating of 4.0 AM 0.05 PPM or better, tested to ASHRAE-110-R.

4. Factory Test facility: Sufficient size to provide unobstructed clearance of five feet each side and ten feet in front of fume hood. Provide make-up air to replace room air exhausted through fume hood and to obtain a negative 0.2" wg room pressure. Introduce make-up air in a manner that minimizes drafts in front of hood to less than 20% of the face velocity. Connect 100 feet per minute air velocity through face of fume hood. Adjustment in blower shall vary face velocity down to 75 feet per minute.

    a. Examine facility to verify conformance to the requirements of this Section.

    b. Test room shall be isolated from all personnel during test procedure.

5. Testing Equipment:

    a. Properly calibrated hot wire thermal anemometer probes equal to Sierra model 600-02; correlate with computer data acquisition format to provide simultaneous readings at all points.

b. Pilot tube and inclined manometer with graduations no greater than 0.2 inch of water, equal to F.W. Dwyer model 400. Calibration curves based on 20. Pilot traverse readings and correlated to a digital readout indicator to provide quick and accurate adjustment of airflows.

c. Tracer gas: Sulfur hexafluoride supplied from a cylinder at a test flow rate of four liters per minute.

d. Ejector system: Tracer gas ejector equal to IHE no. 525-014. Submit sufficient proof of ejector system calibration.

e. Critical orifice: Sized to provide tracer gas at four liters per minute at an upstream pressure of 30 PSIG.

f. Detection instruments: Ion track model 61 leak meter leak meter sulfur hexafluoride detector instrument.

g. Recorder with an accuracy better than plus or minus 0.5% of full scale.

h. Three dimensional mannequin, overall height 67", clothed in a smock.

i. Titanium tetrachloride glass modules. CAUTION: Titanium tetrachloride is corrosive and irritating; skin contact or inhalation shall be avoided.

j. One dozen 30-second smoke bombs.

k. Minihelic dial type static pressure gauge.

6. Preliminary Test and Data:

   a. Provide sketch of room indicating room layout, location of significant equipment, including test hood and other hoods. Provide sketch of air supply system indicating type of supply fixtures.

   b. Reverse air flows and dead space:

      1) Swab strip of titanium tetrachloride along both walls and floor of hood in a line 6" behind and parallel to the hood face, and along the top of the face opening. Swab an 8" diameter circle on the back of the hood. All smoke should be carried to the back of the hood and exhausted.

      2) Test the operation of the bottom air bypass airfoil by running the cotton swab under the airfoil.

      3) If visible fumes flow out of the front of the hood, the hood fails the test and receives no rating.

   c. Face velocity measurements: Face velocity shall be determined by averaging minimum of four and maximum of eight readings at the hood face. Take readings at center of a grid made up of sections of equal area across the top half of the face and sections of equal area across the bottom half of the face. Take simultaneous readings at each point with a series of calibrated hot wire anemometers over a one-minute period of time. Probes shall be correlated to a computer data acquisition package, which will provide an average of each reading over that one-minute period and also an overall average. During the one-minute monitoring period, all velocities must automatically update average at a maximum of four-second intervals.

7. Test Procedure:

   a. Check sash operation by moving sash through its full travel. Verify that sash operation is smooth and easy, and that vertical rising sash shall hold at any height without creeping up or down. Position sash at the full open position for all subsequent tests.

b. Measure exhaust airflow with the baffles positioned to give maximum airflow. Measure exhaust airflow with the baffles positioned to give minimum airflow. Verify that the air volume at minimum airflow is not less than 95% of the exhaust air volume at maximum airflow. Hoods exceeding this fail the test and receive no rating.

c. Take a static pressure reading, using methods assuring an accurate reading, in an area of the ductwork no more than three feet nor less than one foot above the exhaust collar. Static pressure loss shall not exceed values given under Design Requirements stated elsewhere in this Section.

d. Install ejector in test positions. For a typical bench-type hood, three positions are required: left, center and right as seen looking into the hood. In the left position the ejector center line is 12" from the left inside wall of the hood; center position is equal distance from the inside sidewalls; and the right position is 12" from the right inside wall. The ejector body is 6" in from the hood face in all positions. Location of ejector may require modification for hoods of unusual dimensions.

e. Install mannequin positioned in front of the hood, centered on the ejector.

f. Fix detector probe in the region of the nose and mouth of the mannequin. Take care that method of attachment of the probe does not interfere with the flow patterns around the mannequin. Locate nose of the mannequin 9” in front of ejector (3” in front of sash).

g. Open tracer gas block valve. Correlate readings with a computer data acquisition package, which is capable of monitoring and visually recording a minimum of one reading per second for a minimal three minute time period at each of the three positions.

h. The control level rating of the hood shall be the maximum of the three average values for the three test positions.

i. Record performance rating of the fume hood as XXAMyyy, where XX equals the release rate in liters per minute (4.0) and AM represents the as manufactured test sequence and yyy equals the control level in parts per million.

j. Record and submit average face velocity, static pressure, and total exhaust CFM for sash positions from 1/2 open to closed in 2-inch increments. Total variation in face velocity, static pressure, and exhaust CFM shall be in accordance with fume hood general design requirements specified herein.

k. All data on the above test conditions including instrumentation and equipment, test conditions, preliminary test and data information shall be provided on a one page report, including a printout of the average face velocities, and a separate graph-type performance curve on all three tracer gas positions.

l. Ignite a smoke bomb within the fume hood work area to verify that the fumes are quickly and efficiently carried away. Move the lighted bomb about the fume hood work area, checking near fume hood ends and work surface to verify that there is no reverse flow of air at these locations.

m. All fume hoods:

1) Conduct test as outlined with the sash open.

2) Ignite a smoke bomb within the fume hood work area to verify that the fumes are quickly and efficiently carried away. Move the lighted bomb about the fume hood work area, checking near fume hood ends and work surface to verify that there is no reverse flow of air at these locations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify all equipment rough-in conditions and requirements.

B. Coordinate with other trades for the proper and correct installation of electrical rough-in, structural backing for items attached to walls and for rough opening dimensions required for the installation of products in this section.

C. Examine substrate surfaces and associated work and conditions under which work will be installed. Do not proceed until unsatisfactory conditions have been corrected in a manner complying with the Contract Documents and acceptable to the Installer. Starting of work within a particular area will be construed as installer's acceptance of surface conditions.

3.2 INSTALLATION

A. General Requirements:

1. Install in accordance with manufacturer's instructions.
2. Install in accordance with standards required by the governing codes.
3. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.
4. Touch-up minor damaged surfaces caused during installation. Replace damaged components as directed by Architect.
5. Equipment in this section shall be installed with all necessary fittings mounted for final connection by Divisions 22, 23 and 26.

B. Fume Hood Installation

1. Install laboratory fume hoods at locations indicated on drawings, in accordance with approved shop drawings and schedules and according to manufacturer's recommendations.
2. Provide all openings and do all drilling of laboratory furniture necessary for the installation of sinks, cup sinks, service fixtures, electrical service fixtures, conduit fittings and ducts.
3. Install in accordance with codes, regulations and standards required by the authority having jurisdiction.
4. Seismic Restraints: The hood manufacturer shall install the hoods to resist seismic loading as required by the local governing codes. Install all anchorage devices, including special legs and or braces, required for seismic restraint of hoods to satisfy all governing code requirements for seismic anchorage of equipment.
5. Field Quality Control Testing of Fume Hoods (as installed): Additionally, the hood manufacturer shall perform field testing of all fume hoods to ensure that the fume hood and HVAC air flow system complies with all requirements. Field testing shall be accomplished in accordance with the requirements above as outlined in Section 2.1 G1 through G7, and the additional requirements noted below. This field-testing shall be performed with the owner, commissioning consultant, architect and mechanical engineer present.
    a. Field Testing Requirements
        1) Perform tests in field to verify proper operation of the fume hoods before they are put in use, using only qualified personnel.
        2) Perform tests after installation is complete, the building ventilation system has been balanced, all connections have been made, and written verification has been submitted that the above conditions have been met.

3) Verify that the building make-up air system is in operation, the doors and windows are in normal position, and that all other hoods and exhaust devices are operating at designed conditions.

4) Correct any unsafe conditions disclosed by these tests before request of test procedures.

5) Provide the Architect and Owner with a record of all tests.

b. Testing Equipment: Properly calibrated hot wire thermal anemometer equal to Alnor Model No. 8500-1 Compuflow.

c. Test Procedure:

1) Perform field-testing in accordance with ANSI 110. Fume hoods that do not perform to the requirements shall be re-tested following re-balancing of the HVAC system.

2) Check room conditions in front of fume hood using a thermal anemometer and a smoke source to verify that the velocity of cross drafts does not exceed 20% of the specified average fume hood face velocity. Eliminate any cross drafts that exceed these values before proceeding.

3) Perform the following test to verify conformance of actual fume hood face velocities to those specified. Turn on the exhaust system with the sash fully open. Determine the face velocity by averaging the velocity of six readings taken at the fume hood face; at the centers of a grid made up of three sections of equal area across the top half of the fume hood face and three sections of equal area across the bottom half of the fume hood face. If not in accordance with the specifications and drawings, refer to the manufacturer's troubleshooting guide for aid in determining the cause of variation in airflow.

4) Field testing of airflow in fume hoods: Turn on the exhaust system. With sash in open position, check airflow into the fume hood using a cotton swab dipped in titanium tetrachloride or other smoke source. Verify that airflow is into the fume hood over the entire face area by a complete traverse of the fume hood 6" inside the face. Reverse flow is evident of unsafe conditions. Take necessary corrective actions and retest. Move smoke throughout the fume hood directing smoke across the work surface and against the sidewalls and baffle. Verify that smoke is contained within the fume hood and rapidly exhausted.

3.3 ADJUSTING

A. Adjust operating equipment, with the exception of air-moving equipment, to efficient operation for its intended use, and as required by the manufacturer.

B. Adjust fume hood sashes, fixtures, accessories and other moving or operating parts to function smoothly.

3.4 CLEANING

A. Clean equipment and all other surfaces as recommended by the manufacturer, rendering all work in a new and unused appearance. Touch up as required.

B. Clean adjacent construction and surfaces which may have been soiled in the course of installation of work in this section.

C. Clean countertops with diluted dishwashing liquid and water leaving tops free of all grease and streaks. Use no wax or oils.

3.5 PROTECTION OF FINISHED WORK

A. Provide all necessary protective measures to prevent exposure of equipment and surfaces from exposure to other construction activity.

B. Advise general contractor of procedures and precautions for protection of material and installed equipment and casework from damage by work of other trades.

3.6 DEMONSTRATION

A. Provide systems training and demonstration of all equipment operations, functions and calibration process, for a duration of at least 1 hour.

B. Fume hoods: Following successful field testing of fume hoods, fully demonstrate fume hood operation, including sash operation, and electrical service fixture and fitting operation, and operation of the fume hood warning and alarm system.

Refer to Commissioning Specification for training requirements for specific systems and equipment. Training of the Owner's operation and maintenance personnel is required in cooperation with the Commissioning Consultant. Commissioning Specification lists the specific systems and equipment. A training agenda shall be prepared by the Contractor and approved by the Owner prior to training performance.

END OF SECTION 11 53 13

SECTION 11 53 53

BIOLOGICAL SAFETY CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install all biological safety cabinets as shown on drawings and specified.

B. Equipment items specified in this Section include the following:

	**Equipment Number*
1. Biological Safety Cabinets	**BSC4** – Three-foot cabinet

1.2 SCOPE AND CLASSIFICATION

A. This specification covers the requirements for the purchase of bench-mounted Class II, Type A2 biological safety cabinets.

B. Bench-mounted Class II, Type A2 (Unvented) biological safety cabinets in 4-foot widths are covered by this specification.

C. This specification sets the intent for quality, performance and appearance.

1.3 REFERENCES

A. The bench-mounted Class II, Type A2 biological safety cabinets must conform to the following regulations and standards.

B. NSF International – NSF/ANSI Standard 49 for Biohazard Cabinetry.

C. Directive on the Restriction of the use of certain hazardous substances in electrical and electronic equipment (2002/95/EC) – RoHS Directive.

D. The bench-mounted Class II, Type A2 biological safety cabinet must carry the ETL listed mark for the following:

1. UL 61010-1 (formerly 3101-1), Underwriters Laboratories Inc., Electrical Equipment for Laboratory Use.

2. CAN/CSA C22.2 No. 61010-1, Canadian Standards Association, Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use.

1.4 PERFORMANCE REQUIREMENTS

A. General Design Requirements (See Part 2 for details):

1. Class II, Type A2 – Suitable for testing and experimentation with low to moderate risk biological agents.

2. Base Stands (where BSCs are not indicated to be on casework in the drawings)

a. Telescoping Stands – Support base adjustable for eight static height positions allowing the work surface height to be set between 30” (seated position) and 37” (standing position).

3. Seismic requirements are only necessary if required by local governing authority and are the responsibility of the bidder to confirm.

B. Containment & Safety:

1. Cabinet shall provide biological containment protection for both operator and product proven by an actual test (as conducted by NSF) and routinely validated by the manufacturer.
2. Containment of biological hazards is achieved through a combination of HEPA filtration and directional, controlled airflow.

C. Airflow:

1. Calculated Air Velocity: 100 to 110 fpm through 10" sash opening with audible alarms which sound when safety glass sash window is not at its proper operating height.
2. Measured Downflow Velocity: 50 to 60 measured 4" above operating sash opening height.
3. Blower with Electronically Commutated Motor (ECM): Shall be programmed to deliver a precise volume of air as required and automatically adjusts as filters load without relying on airflow sensors and protected from voltage (electrical) fluctuation. Systems using air (velocity or volume) sensors or pressure transducers to control blower speed are not acceptable.
4. The Cabinet shall provide an audio signal accompanied by digital display of alert or alarm status type specific to the alarm with diagnostic measures displayed on a line-of-sight (while seated) color display.

D. HEPA Filters

1. One supply and one exhaust HEPA filter. Each shall be a minimum of 99.99% efficient on all particles 0.3 µm as scan-tested with DOP or equivalent.
2. HEPA filters shall be industry-standard size.
3. Motor-Blower: Shall automatically handle HEPA filter pressure equal to 200% of initial pressure without reducing total air delivery by more than 2%.

E. Controls and Display

1. Cabinet shall utilize a microprocessor control system.
2. Accessible mounted controls for operation of:
   a. Blower
   b. Light
   c. Electrical Outlets
   d. UV Light
   e. Timers
   f. Alarm Mute (5 minute ring-back)
   g. Menu navigation
3. Easy to Use / Navigate Operating System: Performs the following functions:
   a. User Programmable and customizable biological safety cabinet operation (including blower, light, optional UV light and timer functions) controllable by movement and position of the Safety Glass Sash.
   b. User Programmable and customizable biological safety cabinet operation that idles the motor in a reduced flow mode, reducing energy consumption by over 80% while maintaining ISO Class 5 conditions.

c. Digital 12- or 24-hour clock.

d. HEPA filter life is displayed as a percentage using real time feedback from the ECM-blower's performance. HEPA filter life timers are not acceptable.

e. Complete diagnostic and troubleshooting functionality.

f. Security password protection of cabinet use.

g. Programmable timed operation of fluorescent and (optional) germicidal ultraviolet (UV) light.

h. Password Protected Service menu for calibration and configuration of biological safety cabinet installation and operational parameters.

i. Selectable units of measure (Imperial or Metric).

4. Alarms and Alerts: The cabinet provide both an audio signal and digital display that communicates and describes the alarm condition, provides corrective actions and utilizes a cross Sectional diagram highlighting the potentially affected areas of the biological safety cabinet. Alarms shall exist for the following conditions:

a. Sash Height Alarm: Indicating that the sash is higher than its nominal set point.

b. Airflow Alert: Signifies that the automatically adjusting blower has had to make an abrupt change in order to maintain safe airflow.

c. Airflow Alarm (if equipped with an airflow sensor): Indicates that inflow or downflow velocities are excessively high or low.

d. Canopy Alarm (if canopy kit is installed): Indicates insufficient exhaust system airflow. See Canopy Kit Accessory Details.

e. System Error: Indicates a failure in the communication between the microprocessor controller and the ECM blower.

F. Noise

1. Sound level (as factory tested): Shall be no more than 63 dBA measured 15 inches above the work surface and 12 inches in front of the safety glass sash, as stated by NSF/ANSI Standard 49.

G. Illumination

1. Fluorescent lighting shall provide 90 to 150 foot-candles on work surface per NSF/ANSI Standard 49. The ballast is to be electric containing thermal protection with automatic reset.

2. Fluorescent lighting shall be externally mounted from the work zone, energy efficient and replaceable from the front end of the biological safety cabinet.

3. Optional UV light shall be a 254-nanometer germicidal lamp with life timer and replacement notifications.

4. The UV light shall be operable only when the sash is closed.

H. Pass-Through and Bulkheads

1. Sealed Service Pass-Through: All permanent and durable structures for the passing of electrical wires, cords and tubes are to be permanently sealed air-tight, and shall not allow for movement of the items passing through.

2. Sealed Service Penetration: Penetrations will be air tight and sealed, and will provide for the addition of field installed service fixture/valves or testing equipment.

3. User-Modified Pass-Through: Cord, Tube & Cable Portals for the passing of such so to connect to instruments, one inside the biological safety cabinet, the other outside. Shall provide an airtight seal and be protected by a vacuum or negative pressure source.
4. All Pass-Through & Bulkhead types shall be tested and approved by NSF to the NSF/ANSI STANDARD 49.

I. Efficiency

1. Biological safety cabinets shall operate at, or lower than, the listed energy usage and heat output during normal operation:
    a. 4' Models: 290 Watts / 990 BTU-HR
2. During periods of non-use, the cabinet's set-back should operate at an 85% reduction in energy consumption.

1.5 QUALITY ASSURANCE

A. NSF Qualification

1. Biological safety cabinets, Class II, Type A2, will meet or exceed the minimum requirements of NSF/ANSI Standard 49, bear the NSF Mark and appear in NSF's Official Product Listings.

B. Manufacturer Qualification

1. ISO 9001 Certified manufacturing plant and processes.
2. Manufacturer must maintain a testing facility at their place of business for the performance testing of bench-mounted Class II, Type A2 biological safety cabinets.
3. The test facility and manufacturing facility must be available for Owner/User inspection and its quality control procedures.
4. Manufacturer shall provide evidence and documentation of specialization and manufacturing of biological safety cabinets with a minimum of no less than ten years' experience to the market.
5. All biological safety cabinets wired for 115V, 60Hz and 230V, 60Hz shall be built to meet or exceed all minimum requirements of UL Standard 61010-1 (formerly 3101-1) and CAN/CSA C22.2 No. 1010.1. The biological safety cabinets shall be listed by a Nationally Recognized Testing Laboratory (NRTL).

C. Biological safety cabinets shall be "Made in America".

1. 95% or more of raw material and component suppliers shall be United States based.
2. Stainless and cold rolled steel used in manufacturing shall be sourced from United States steel mills.
3. Final product must be fabricated and assembled within the United States of America.
4. Owner reserves the right to evaluate Made in America claims for compliance with the Bureau of Consumer Protection.

D. Supply all equipment in accordance with this specification. Offering a product differing in materials, construction or performance from this specification requires written approval obtained seven days or more before the proposal deadline.

E. The Owner/Architect reserves the right to reject qualified or alternate proposals and to award based on product value where such action assures the Owner greater integrity of product.

F. Manufacturer's warranty against defects in material or workmanship on its biological safety cabinets will be for 5 years from the date of installation or 6 years from date of purchase, whichever is sooner, and includes replacement of parts (excluding filters and lamps) and labor.

1.6 SUBMITTALS

A. Action Submittals:

1. Biological Safety Cabinet specification sheets and product manuals shall be submitted by the manufacturer upon request, and include safe and proper operation and maintenance information.

2. Shop Drawings: Include plans, elevations, sections and details.

a. Indicate details for anchoring biological safety cabinets to the floor as required by the seismic code.

b. Indicate locations and types of service fittings together with the associated service supply connection required.

c. Include roughing-in information for electrical connections.

B. Information Submittals:

1. Production Test Reports: A copy of the "as manufactured" test reports conducted prior to shipping ensures compliance with NSF/ANSI Standard 49 and is shipped with each biological safety cabinet.

2. Independent Validation:

a. Written verification that the biological safety cabinets carry listed markings for the following:

1) NSF/ANSI Standard 49, National Sanitation Foundation, (Laminar Flow) Biological Safety Cabinetry

2) UL 61010-1 (formerly 3101-1), Underwriters Laboratories Inc., Electrical Equipment for Laboratory Use (115V & 230V, 60Hz Models)

3) CAN/CSA C22.2 No. 61010-1, Canadian Standards Association, Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use (115V & 230V, 60Hz Models)

3. Documentation of ISO 9001 Certified manufacturing plant and processes.

4. List of five installations (of equal or greater size/scope and requirements) is available upon request.

5. Declaration of Made in America. Owner reserves the right to evaluate Made in America claims for compliance with the Bureau of Consumer Protection.

6. Start-Up Test Report shall be submitted by an independent third party, accredited by NSF to test and balance biological safety cabinets.

C. Seismic Restraints: The biological safety cabinet manufacturer / installer shall design and install the biological safety cabinets to resist seismic loading as required by the local governing codes. Provide all seismic details with submittals indicating required wall construction, such as wall stud size and gauge, point loads, etc. Install all anchorage devices, including special legs and / or braces, required for seismic restraint of biological safety cabinets to satisfy all governing code requirements for seismic anchorage of equipment.

1.7 DELIVERY, STORAGE AND HANDLING

A. Protect finished surfaces during handling, installation and thru completion of construction with protective covering of polyethylene film or other suitable material.

B. Schedule delivery of equipment so that spaces are sufficiently complete that equipment can be installed immediately following delivery.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install biological safety cabinet until building is enclosed, wet work and utility roughing-in are complete and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Labconco Corporation Kansas City, Missouri
2. NuAire Plymouth, Minnesota
3. The Baker Company Stanford, Maine

B. Comparable by one of the following permitted following substitution request and approval.

C. Other substitutions not permitted.

2.2 MATERIALS

A. Biological Safety Cabinet Interior

1. The Interior Liner (sides and back) shall be 16-gauge, Type 314 Stainless Steel.
2. The Work Surface shall be 18-gauge or greater, Type 314 Stainless Steel.
3. Motor shall be thermally protected, DC-ECM type with resilient mounted bearings. Motors with bushings are not acceptable.
   a. 1/2 HP ECM shall provide 42 Oz-Ft of torque.
   b. 3/4 HP ECM shall provide 66 Oz-Ft of torque.
4. Electrical Outlets will have interlocking ground fault interruption.
5. Internal ductwork and plenums shall be galvanized and/or stainless steel shall be RoHS compliant. Flexible, removable or replaceable plenums and ductwork are not acceptable.
6. Safety Glass Sash shall be 1/4” thick tempered safety glass.

B. Biological Safety Cabinet Exterior

1. Exterior panels shall be powder-coated, 18-gauge cold rolled steel.

C. HEPA Filters

1. Filters are to be borosilicate glass, mini-pleat and separator-less HEPA filters.
2. Filter frames shall be aluminum with closed cell neoprene gaskets.

2.3 CONSTRUCTION

A. Biological Safety Cabinet Interior

1. Unitized single-frame construction of 16-gauge, 314 Stainless Steel. Shall pass factory test for holding pressure of 2” w.g. per NSF/ANSI Standard 49.
2. Cabinet assembly shall be constructed such that all positive pressure contaminated plenums are surrounded by negative pressure plenums.
3. Drain trough beneath the work tray is equipped to accommodate a 3/8” ball-type drain valve.
4. Optional service fixture (on models with fixture) shall be quarter-turn, ball valve.
    a. Valve shall be constructed of chrome-plated brass (or other based on requirements of service/utility provided).
    b. Location of fixtures shall be ADA compliant for wheelchair accessibility.
5. Internal air balancing system shall be accessible from the outside of the biological safety cabinet, and adjustable with a standard hex-nut driver.
6. The Work Surface shall be of single piece, stamped construction with no welding, applied sealant or solder used to seal any surface. All internal radiuses are 1/2” or greater.
7. A metallic diffuser screen shall promote true laminar air flow.
8. The cabinet shall accommodate up to 4 service fixtures.
9. The cabinet shall be double wall construction with negative pressure airflow from drain pan to top surrounding the back of work area.

B. Biological Safety Cabinet Exterior

1. Exterior front panel shall slope approximately 10° and has no visibility-interfering protrusions.
2. Cabinet is designed such that all major service operations can be performed from the front of the cabinet.
3. HEPA filters are removable from the front of the cabinet.
4. A steel diffuser shall be mounted on top of the biological safety cabinet to promote proper exhaust airflow and protect the Exhaust HEPA filter.

C. Dimensions

1. The biological safety cabinet shall be capable of transport through a 32” wide opening.
2. Overall exterior dimensions are as follows: (excluding Base Support)
    a. 3 foot nominal width: 42.3”w x 61.7”h x 31.2”d
3. Overall interior dimensions are as follows:
    a. 3 foot nominal width: 36.5”w x 61.7”h x 25.6”d

D. Blower

1. Blower assembly shall be direct drive powered by energy saving ECM motor type.
    a. 3’ and 4’ models will utilize a 1/2 HP ECM.
    b. 6’ models will utilize a 3/4 HP ECM.

c. Motor mounting system shall consist of 16-gauge, stamped steel legs with integral vibration isolation.

2. Blower shall be optimally determined forward-curved fan for each model size/width to maximize both energy efficiency and filter loading capacity.

E. Sash Assembly

1. Sash shall be single pane, tempered safety glass and angled 10° from vertical and be of a sliding operation.
2. Sash shall be capable of being closed when the cabinet is not in operation.
3. Sash shall fully open to a height of 22.6".
4. Total sash height shall provide a viewing window that is no less than 27.0" tall.
5. A sash position indicator shall identify to the user where the sash is to be open to its optimum operating level.
6. Sash shall not require removal for routine filter or motor/blower service.
7. Bottom edge of sash shall be frameless and ground to a smooth edge so as to not disrupt line of sight. Framed sashes are not acceptable.
8. Sash will be interlocked to the cabinet operation such that UV light (if equipped) will not operate when sash is open, and the biological safety cabinet will alarm (audio & visual) when the sash is opened beyond its nominal height when the blower is in operation.
9. Provide guides capable of holding the sash in place regardless of position and cushion sash with bumpers when fully opened or closed.
10. Maximum force required to operate sash shall not exceed 7 lbs.

F. Airflow and Foils

1. Bottom of sash opening (Air Inlet Grille) is an aerodynamic, radiused foil to ensure smooth, even flow of air into biological safety cabinet.
2. Air inlet grille will have perforations on the leading edge to draw air into the biological safety cabinet should the operator inadvertently block the grille area.
3. Corner posts are designed to be aerodynamic to ensure smooth, even flow of air into the sides of the sash opening on the biological safety cabinet.
4. A negative pressure channel shall exist at the top of the sash opening to prevent loss of containment at the top of the sash. Mechanical wipers at the top of the work area promote the creation of hazardous aerosols and are not acceptable.

G. Electrical

1. A 10-foot 3-wire cord and plug will be provided to connect to electrical supply.

a. 3' and 4' 115V models will be provided with an IEC 60320 connector and NEMA 5-15 plug.

b. 6' 115V models will be provided with an IEC 60320 connector and NEMA 5-20 plug.

2. Two internal Electrical Outlet Duplexes will be standard, one mounted on each side wall. Outlets mounted on the rear wall of the work area are not ADA compliant and are not acceptable.

a. Duplexes shall be mounted flush to the stainless-steel side walls of the biological safety cabinet's interior for easy cleaning.

b. Duplexes will have a self-closing stainless steel splash cover with dampened (slowed action) operation for safe operator use. Splash covers shall fully close in 1 second or greater. Undampened, spring-loaded doors are not acceptable.

c. Duplexes will be located in compliance with ADA for wheelchair accessibility.

d. 115V model receptacles are NEMA 5-15.

3. All major electronic components (ballasts, starters, switches, circuit breakers) shall be housed in a removable module for service or testing and be accessible from the front.

4. Wiring Harness shall be color coded and alphanumerically labeled for identification. Removable wire tags shall not be used.

5. Biological Safety Cabinet shall have two separate internal circuits with breaker protection. One for service of controls, lighting and blower motor; one for internal electrical outlets.

6. Biological Safety Cabinet shall have optional dry relay contacts for connection to building management system. Will communicate alarms or use for control of HVAC Mechanical System (remote blower, valves) devices.

H. Decontamination

1. Cabinet shall be easily fumigated employing an established procedure such as that recommended by NSF/ANSI Standard 49.

2. Cabinet shall be provided with a 1" nominal diameter corrugated tube supplying a vaporized sterilant (Vaporized Hydrogen Peroxide – VHP, or Chlorine Dioxide – CD) to the positive pressure contaminated plenum for maximizing decontamination efficiency. Tube shall have a bright orange safety cap and be accessible from the front of the cabinet.

3. Linear assembly shall have an integral face flange for sealing the cabinet during decontamination and pressure test operations.

4. The biological safety cabinet's controls will provide a program that cycles the motor blower for maximizing decontamination efficiency.

I. HEPA filters and Plenums

1. The positive pressure, contaminated plenum shall be permanent in construction, telescoping steel and provide uniform HEPA filter loading, Flexible, consumable plasticized plenums are not acceptable.

2. Supply HEPA filter shall be of full cabinet work zone width and depth, and be tilted with the angle of the biological safety cabinet's front so as to provide laminar airflow behind the sash.

3. Supply HEPA filter shall be protected by a perforated metal diffuser covering the entire top of the work zone.

4. Supply and Exhaust HEPA filters are secured in the upper cabinet assembly by clamps.

J. Controls and Display

1. Control panel with easy-to-clean membrane touchpad for system operations (blower, lights, mute) and Operating System navigation are mounted on the front of the cabinet and shall be ADA compliant. Controls mounted above sash are not acceptable.
2. The audible/visual alarm indicator and mute switch shall be ADA compliant.
3. The mute function will silence audible alarms for 5 minutes before engaging a ring-back function.
4. Display shall be mounted in a position where it is line-of-sight while seated at the cabinet and can be viewed without strain to the operator.
5. Display shall be Digital LCD and communicate cabinet status, HEPA filter life, alarms and cabinet set up. Analog pressure gauges do not adequately provide user communication adequate to specific cabinet function and are not acceptable.

K. Pass-Through and Bulkheads

1. Service Fixture Provisions will be provided to accommodate up to four valve installations, shall be sealed to meet air tight pressure requirements and shall be ADA compliant.
2. Cord and Cable Portal shall ship with a solid closed cell neoprene plug and be user-modified as needed per application.
3. Cord and Cable Portals shall not require further space requirements than recommended by the manufacturer and NSF/ANSI Standard 49.
4. Cord and Cable Portal design shall be approved by NSF testing.

L. Ergonomics: The Biological Safety Cabinet shall be ergonomically designed for maximum use comfort and adjustability to meet the requirements of the Americans with Disabilities Act (ADA).

1. Biological Safety Cabinet installation with base stand shall be positioned to provide work surface heights between 30” and 37” and be in compliance with ADA.
2. Safety Glass Sash Assembly shall be anti-racking and counterbalanced with a weight and pulley system allowing for effortless movement up and down with one hand. Sash shall open to 21.7”. Spring-loaded sash counterbalances require greater force as the sash raises and exerts force against the user’s arms; this design is not acceptable.
3. Air Inlet Grille shall have a large (greater than 2”) integrated curved armrest to provide comfort for user when in a resting position while maintaining containment performance. Hard and sharp angles and elevated add-on arm/elbow rests promote poor ergonomic posture and are not acceptable.
4. Maximum visibility into cabinet work zone shall be at least 27” from front access airfoil to exterior light housing.
5. The Biological Safety Cabinet’s work surface shall have easy-lift knobs located on the front corners and be removable through the front opening. The stamped dish will have coved corners for easy cleaning.
6. The Biological Safety Cabinet shall have a 10° slope front.
7. All controls (touchpad, service fixture valves, electrical outlet duplexes, cord and cable portals) shall be incompliance with ADA.

8. The digital display shall be positioned line-of-sight while seated at the Biological Safety Cabinet and communicate cabinet status and programming full intuitive sentences.

M. Required Accessories

1. Telescoping Base Stands: Shall be adjustable at installation to provide work surface heights between 30” and 37” and come with leg levelers. Shall be NSF Approved.
   a. Powder coated steel square tubing construction.
   b. Shall include a full width storage shelf.
   c. Shall be capable of adding 5” casters.
   d. Seismic restraints with anchor bolts for floor mount design.
2. Air-tight Damper with flange to mate to top of canopy exhaust transition, control airflow through canopy and allow proper decontamination of the biological safety cabinet.
3. Ultraviolet (UV) lamp: Germicidal 254 nm wavelength lamp. Shall be NSF Approved.
4. Utility Valves: Greaseless, allowing for connection of service utilities (air, vacuum, gas)
5. Mass Airflow Monitor with integration into operating system that provides digital display of airflow readings and audible/visual alarms should readings be excessively low or high.
6. Ergonomic Footrest.
7. Ergonomic Stainless Steel Turn Table.
8. RS 232 Connection ports.
9. Seismic Restraints: As required by local governance and code.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of biological safety cabinets.

B. Coordinate with other trades for the proper and correct installation of plumbing and electrical rough-in and for rough opening dimensions required for the installation of biological safety cabinets.

C. Examine the carton and its contents for damage that might have occurred in transit.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install Biological safety cabinets according to shop drawings and manufacturer’s written instructions.

B. Install level, plumb and true; securely anchor as required.

C. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

D. Install according to standards required by Authority Having Jurisdiction.

E. Touch up minor damaged surfaces caused by installation. Replace damaged components as directed by Architect.

3.3 FIELD QUALITY CONTROL

A. NSF/ANSI Standard 49 requires that biological safety cabinets be field tested after installation and prior to use.

1. A qualified independent (third party) certifier should certify the cabinet in accordance with NSF/ANSI Standard 49, Annex F.

2. Make all corrections until biological safety cabinet passes NSF/ANSI 49 Field Certification.

3. If connected to building HVAC system, retest all other ventilation equipment that failed to perform as specified.

3.4 ADJUSTING AND CLEANING

A. Adjust moving parts for smooth, near silent, accurate sash operation with one hand. Verify that counterbalances operate without interference.

B. Clean finished surfaces, including both sides of glass; tough up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

C. Clean adjacent construction and surfaces that may have been soiled or damaged in the course of installation of work in this Section.

D. Provide all necessary protective measures to prevent exposure of equipment and surfaces from exposure to other construction activity.

E. Advise contractor of procedures and precautions for protection of material and installed equipment and casework from damage by work of other trades.

END OF SECTION 11 53 53

SECTION 12 20 00

WINDOW TREATMENT

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.2 SCOPE OF WORK SUMMARY

A. Manually operated, roll-up fabric interior window shades including mounting and operating hardware.
B. Motorized, roll-up fabric interior window shades including motor operator, controls, and mounting hardware.

1.3 STANDARDS AND REFERENCES

A. NFPA 70 - National Electrical Code.
B. NFPA 701-99 - Fire Tests for Flame-Resistant Textiles and Films.
C. GREENGUARD Environmental Institute Gold.
D. US Green Building Council.
E. ANSI/WCMA A100.1-2018

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum of twenty years documented experience in manufacturing products comparable to those specified in this section. Manufacturers that do not meet the required experience requirements must submit life cycle test data showing minimum 2000 complete operational cycles for each year of warranty showing no failure and that shade remains fit for use as a operable shade).
B. NFPA Flame-Test: Passes NFPA 701. Materials tested shall be identical to products proposed for use.
C. Mock-Up: Provide a mock-up of one of each type roller shade assembly specified for evaluation of mounting, appearance and accessories.

1. Locate mock-up in window(s) designated by Architect.
2. Do not proceed with remaining work until mock-up is accepted by Architect.

1.5 SUBSTITUTIONS

Substitutions will be considered per Section 01 25 00 Substitution Procedures.

1.6 SUBMITTALS

A. Submit under provisions of Section 01 33 00 Submittal Procedures:
B. Product Data: Manufacturer's data sheets on each product specified, including:

1. Preparation instructions and recommendations.
2. Installation and maintenance instructions.
3. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.
4. NFPA Flame-Test: Passes NFPA 701 including certification from manufacturer that

the fabrics sourced for this project comply with the test data provided.
5. Storage and handling requirements and recommendations.
6. Mounting details and installation methods.
7. Typical wiring diagrams including integration of motor controllers with building management system, audiovisual and lighting control systems as applicable.

C. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams and relationship to adjacent work.
D. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings, field verified window dimensions, quantities, type of shade, controls, fabric, and color, and include opening sizes and key to typical mounting details.
E. Selection Samples: For each finish product specified, two complete sets of shade cloth options and aluminum finish color samples representing manufacturer's full range of available colors and patterns.
F. Verification Samples: For each finish product specified, two complete sets of shade components, unassembled, demonstrating compliance with specified requirements. Shade fabric sample and aluminum finish sample as selected, representing actual product, color, and patterns. Mark face of material to indicate interior faces.
G. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.
H. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
I. Warranty: Properly executed manufacturer’s warranty.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver window shades until building is enclosed and construction within spaces where shades will be installed is substantially complete.
B. Deliver products in manufacturer's original, unopened, undamaged containers with labels intact.
C. Label containers and shades according to Window Shade Schedule.
D. Store products in manufacturer's unopened packaging until ready for installation.

1.8 SEQUENCING

A. Ensure that locating templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.
B. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.9 PROJECT CONDITIONS

A. Install roller shades after finish work and ambient temperature, humidity and ventilation conditions are maintained at levels recommended for project upon completion.

1.10 WARRANTY

A. Hardware and Shade Fabric: Draper standard twenty-five year limited warranty.
B. Motors and Controls: Draper standard five-year limited warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Draper Inc., which is located at: 411 S. Pearl Street P. O. Box 425; Spiceland, IN 47385-0425; Toll Free Tel: 800-238-7999; Tel: 765-987-7999; Fax: 866-637-5611; Kathy Greenway 714 396 9732
B. Or Architect approved equal.

2.2 MANUALLY OPERATED WINDOW SHADES

A. Heavy-Duty Manually Operated Window Shades with Independent Control: Manually operated, vertical roll-up, fabric window shade with components necessary for complete installation; Clutch-Operated FlexShade NEXD as manufactured by Draper, Inc.

1. Operation: Bead chain and clutch operating mechanism allowing shade to stop when chain is released. Designed never to need adjustment or lubrication. Provide limit stops to prevent shade from being raised or lowered too far.

a. Spring-Assist Clutch: Adjustment-free system includes spring-assist components to reduce lifting forces required to raise the shade. Manufacturer shall provide estimated torque for shade unit. Spring-assist is recommended on estimated non-spring-assist torque above 6 lb-in; required on shades with an estimated torque higher than 15 lb-in.
b. Bead Chain Hold Down: Spring-Loaded Tensioner complying with ANSI/WCMA A100.1-2018 safety standard.
c. Idler end: Height adjustable idler end allows fine leveling adjustments after installation-min plus or minus 1/8 inch without shimming brackets. Contains at least two entry points for the idler end. Safety engagement feature requires idler end pin to have a minimum engagement in bracket, ensuring that the idler end cannot fall out of the bracket due to lack of pin engagement.

2. Single Roller Configuration:

a. Mounting:

1) Endcaps and fascia.

b. Fascia: L shaped aluminum extrusion to conceal shade roller and hardware.

1) Attachment: Snaps onto endcaps without requiring exposed fasteners of any kind. Fascia can be mounted continuously across two or more shade bands. Notching of fascia to provide for chain clearance is NOT acceptable. Fascia height to match throughout space unless specifically approved in advance by the Architect
2) Selected from Manufacturers standard range.

c. Roller Tube: Fabricated from extruded aluminum, galvanized steel, or enameled steel. Diameter, wall thickness, and material selected by manufacturer to accommodate shade type and size. Minimum roller diameter 1.5 inches. Tube diameters less than 1.5 inches shall not be acceptable unless manufacturer provides deflection analysis showing deflection limited to <= width (inches) /700 at 1.5X design load.

1) Fabric to tube attachments: Spline fabric/roller attachment system to allow shade fabric to be removed from roller without having to remove roller from brackets.

d. Shade slat:

1) Closed pocket elliptical slat: 1 inch (25 mm) aluminum elliptical slat inside of a 1-5/8-inch (41 mm) pocket with heat sealed ends.

3. Rollers: Extruded aluminum roller tube of appropriate diameter to support shade fabric with minimal deflection.

a. Minimum Roller Tube Diameter: 1.5 inches (32 mm). Tube diameters less than 1.5 inches shall not be acceptable unless manufacturer provides deflection analysis showing deflection limited to <= width (inches) /700 at 1.5X design load.
b. Fabric Connection to Roller Tube: Spline fabric/roller attachment system to allow shade fabric to be removed from roller without having to remove roller from brackets.
c. Fabric Length: 6 inches (152 mm) greater than window height minimum.
d. Hembar: Extruded aluminum, finished to match fascia.

2.3 MANUALLY OPERATED WINDOW SHADES Dual

A. Heavy-Duty Manually Operated Window Shades with Independent Control: Manually operated, vertical roll-up, fabric window shade with components necessary for complete installation; Clutch-Operated FlexShade NEXD as manufactured by Draper, Inc.

1. Operation: Bead chain and clutch operating mechanism allowing shade to stop when chain is released. Designed never to need adjustment or lubrication. Provide limit stops to prevent shade from being raised or lowered too far.

a. Spring-Assist Clutch: Adjustment-free system includes spring-assist components to reduce lifting forces required to raise the shade. Manufacturer shall provide estimated torque for shade unit. Spring-assist is recommended on estimated non-spring-assist torque above 6 lb-in; required on shades with an estimated torque higher than 15 lb-in.
b. Bead Chain Hold Down: Spring-Loaded Tensioner complying with ANSI/WCMA A100.1-2018 safety standard.
c. Idler end: Height adjustable idler end allows fine leveling adjustments after installation-min plus or minus 1/8 inch without shimming brackets. Contains at least two entry points for the idler end. Safety engagement feature requires idler end pin to have a minimum engagement in bracket, ensuring that the idler end cannot fall out of the bracket due to lack of pin engagement.

2. Dual Roller Configuration / Mounting:

a. Dual roller fascia. Endcaps with fascia designed for surface mounting of dual roller window shades.

1) Endcaps: 1028 steel stamping.
2) Fascia: L-shaped cover of extruded aluminum, .060 wall. Assembly snaps onto endcaps without exposed fasteners.
3) Size: 4-3/4 inches deep x 7 inches high x length required by window opening.
4) Finish: Selected from Manufacturers standard range.

b. Shade slat:

1) Closed pocket elliptical slat: 1 inch (25 mm) aluminum elliptical slat inside of a 1-5/8-inch (41 mm) pocket with heat sealed ends.

3. Rollers: Extruded aluminum roller tube of appropriate diameter to support shade fabric

with minimal deflection.

a. Minimum Roller Tube Diameter: 1.5 inches (32 mm). Tube diameters less than 1.5 inches shall not be acceptable unless manufacturer provides deflection analysis showing deflection limited to <= width (inches) /700 at 1.5X design load.
b. Fabric Connection to Roller Tube: Spline fabric/roller attachment system to allow shade fabric to be removed from roller without having to remove roller from brackets.
c. Fabric Length: 6 inches (152 mm) greater than window height minimum. Hembar: Extruded aluminum, finished to match fascia

2.4 MOTORIZED WINDOW SHADES

A. Shade Motor and Control System

1. FlexShade Recharge. Lithium-Ion battery powered motor with built-in radio receiver. Includes Ion Lithium batteries. No external wiring required. Tubular motor and batteries concealed inside each shade roller tube.

a. 12V Power Adapter.
b. Recharge Motor Cable Extender - 96 inches.
c. Individual Control, Group Control and Individual and Group Control:

1) Five channel wireless wall switch for radio motor control.

B. Roller: Fabricated from extruded aluminum or steel. Wall thickness and material selected by manufacturer to accommodate shade size. Provide with roller idler assembly of molded nylon and zinc-plated steel pin. Sliding pin to allow easy installation and removal of roller. Fabric connected to the roller tube with LSE (low surface energy) double sided adhesive specifically developed to attach coated textiles to metal. Adhesive attachment to eliminate horizontal impressions in fabric

2.5 FREE HANGING SHADE (ABOVE DOOR WINDOW)

A. Fabric selection either Infinity2 3% or black out

1. Architect to select fabric
2. Wall mount
3. Window section above doors
4. Shade is not operable

2.6 FABRIC

A. Light-Filtering Fabrics

1. Thermoplastic Olefin

a. Basketweave

1) SheerWeave Infinity2 3%: sustainable window treatment fabric eco-friendly basketweave. Core yarn and coating are PVC-free, lead-free and 100 percent recyclable. Fire classification: ASTM E-84 (Class I), NFPA 701-2004 TM#1 (small scale), NFPA 101 (Class A Rating) and CAN/ULC-S 109-03 Large, UL GREENGUARD, GREENGUARD Gold. 3 percent open. Average Fabric Thickness: .031 inch (.79 mm) Average Fabric Weight: 13.69 ounces per square yard.

B. Room Darkening Fabrics

1. Opaque

a. Polyester

1) SheerWeave Series SW7000 Blackout by Phifer: PVC-free polyester with acrylic foamed backing. Fire rating: California U.S. Title 19 (small scale), BS 5867 Part 2 Type B Performance, IBC Section 803.1.1 (Class A Rating), NFPA 101 (Class A Rating), NFPA 701 TM#1 (small scale), CAN/ULC-S 109 (large and small scale), CAN/CGSB2-4. 162-M80. Bacteria and fungal resistance: ASTM G21, AATCC 174-1998 Part II and III. E/nvironmental certification: Certified to UL GREENGUARD and GREENGUARD Gold standards for low chemical emissions into indoor air during product usage. Safe use: RoHS/Directive 2002/95/EC, US Consumer Product Safety Commission Section 101 and ANSI/WCMA A 100.1-2007 for lead content. Draper shades made with this fabric are GreenSpec listed. Opaque, .030 inches thick, 13.92 oz/square yard.

C. Color and pattern: As indicated in Drawings.

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.

3.2 PREPARATION

A. Coordinate requirements for blocking and structural supports to ensure adequate means for installation of window shades.
B. Coordinate requirements for power supply conduit, and wiring required for window shade motors and controls.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Install roller shades level, plumb, square, and true. Allow proper clearances for window operation hardware.
C. Shade pockets:

1. Install shade pockets prior to installation of suspended ceiling system. Attach to supporting structure with screws through top of pocket at 24 inches (610 mm) minimum centers.
2. Install shade pockets in conjunction with installation of suspended ceiling system. Attach to supporting structure with screws through top of pocket at 24 inches (610 mm) minimum centers.
3. Install corner pieces securely and in alignment with pockets.
4. Install pocket ends securely and in alignment with pockets.
5. After interior construction is essentially complete, install shade and operating mechanism in pocket.

D. Install the following items to conceal roller and operating mechanism. Do not use exposed fasteners.

1. Fascias.

3.4 TESTING AND DEMONSTRATION

A. Test motorized window shades to verify that controls, limit switches, interface to other building systems, and other operating components are functional. Correct deficiencies.
B. Test window shades to verify that operating mechanism, fabric retainer, and other operating components are functional. Correct deficiencies.

1. Chain and clutch.
2. Motorized operating mechanism.

C. Demonstrate operation of shades to Owner's designated representatives.

3.5 PROTECTION

A. Protect installed products until completion of project.
B. Touch-up, repair or replace damaged products before Substantial Completion.

3.6 SCHEDULES

A. Manually Operated Shades:

1. Shade Type SM-1 Single Roller
    a. Mounting Type:
2. Shade Type SM-2 Dual Roller
    a. Mounting Type:

B. Motorized Shades:

1. Shade Type MS-1 Single Roller
    a. Configuration/Mounting:
2. Shade Type MS-2 Dual Roller
    a. Configuration/Mounting:

END OF SECTION

SECTION 12 35 53

LABORATORY CASEWORK & ACCESSORIES

PART 1-GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Furnishing all laboratory cabinets and casework, including lab countertops, lab sinks, ledges, supporting structures, lab service fittings and miscellaneous items of equipment as listed below and in these specifications or equipment schedules including delivery to the building, setting in place, leveling and scribing to walls and floors as required. Furnish and install all filler panels (**FP**), knee space panels and scribes as indicated by drawings. Divisions 22, 23 and 26 shall be responsible for final connections of the laboratory sinks, laboratory fixtures and accessories specified herein.

a. Fixed Modular Steel Laboratory Casework

b. Flammable Chemical and Acid Storage Cabinets

c. Laboratory Countertop Surfaces & Backsplashes

d. Laboratory Sinks

e. Laboratory Epoxy Resin Drying Racks

f. Laboratory Plumbing & Electrical Fittings

g. Laboratory Casework Accessories

B. Work Not Included in this Section:

1. Equipment, materials and labor which are the responsibility of other subcontractors, as determined by the General Contractor may include the following:

a. Electrical receptacles, except where integral to casework, pulling of wire and connecting of electrical fittings in service chases and countertop outlets that are not part of the casework.

b. Plumbing fittings not included in this section, vacuum breakers (except in-line vacuum breakers specified in this section), piping or other plumbing features, as required to meet local code authority requirements.

1.2 RELATED DOCUMENTS: The completion of the work described in this Section may require work in or coordination with other Sections of these specifications. The Contractor and the subcontractor will be responsible for identifying and including all related work in other Sections of these specifications and / or drawings necessary for a complete installation of the work described in this Section. These related sections include, but are not limited to the following:

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

B. Refer to Divisions 22, 23 and 26 and the Mechanical and Electrical drawings for related plumbing, mechanical and electrical work, including plumbing work related to purified water systems.

C. Division 5 & 6: Blocking and backing in walls for anchorage of cabinetry

D. Division 9: Blocking and backing in walls for anchorage of cabinetry

E. Division 9: Base molding and flooring

F. Division 11 53 00: Laboratory Equipment

G. Division 11 53 13: Fume Hoods

H. Division 11 53 53: Biological Safety Cabinets

I. Division 23: Laboratory Temperature and Airflow Control System

J. Division 23: Control Instrumentation

K. Division 23: Air Valves

L. Division 23: Direct Digital Control System

M. Division 23: Control & Automation Material

N. Division 23: Sequence of Operation

O. Division 26: Electrical Fittings and Connections

P. System commissioning is a part of the construction process. Documentation and testing of systems, as well as training of the Owner's operation and maintenance personnel, is required in cooperation with the Commissioning Consultant. Substantial Completion is dependent on successful completion of all commissioning procedures, documentation and issue closure. Refer to Commissioning Specification Section for detailed commissioning requirements.

1.3 REFERENCES

A. Flammable Chemical and Acid Storage Cabinets:

1. OSHA Section 1910.106, General Industry Standards
2. NFPA 30, Flammable and Combustible Liquids Code
3. UL 1275, Flammable Liquid Storage Cabinets

B. Emergency Eyewash and Shower:

1. ANSI Z-358.1
2. ADA

1.4 SUBMITTALS

1. Manufacturer's Installation Instruction: Indicate special installation requirements.
2. Seismic Restraints: The lab casework manufacturer / installer shall install the casework to resist seismic loading as required by the local governing codes. Provide all seismic details with lab casework and fume hood submittals indicating required wall construction, such as wall stud gauge and size, point loads, etc. install all anchorage devices, including special legs and / or braces required for seismic restraint of lab casework, fume hoods and accessories to satisfy all governing code requirements for seismic anchorage of equipment.
3. Instruction: Submit for review and approval written approval instructions in booklet form providing additional details on safe operation and maintenance.

B. Samples: Provide the following samples:

1. Finish Samples: Submit 2 sets of samples of each color of finish for casework, work surfaces and other prefinished work as well as accessories for selection by interior designer.
2. Hardware Samples: Provide 1 set of all hardware components.
3. 4"x4" countertop samples, provide all color options.

C. Mock Up: On site review prior to primary installation:

1. Install all laboratory casework and fittings in an Architect selected smaller representative lab area prior to installing the bulk of casework throughout the project and request review.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit information in bound manual form on 8-1/2" x 11" paper, and electronically as a portable document format (PDF).

B. Operation Data: Include description of required operation, adjusting and testing.

C. Maintenance Data: Identify system maintenance requirements, servicing cycles and spare part sources.

1.6 QUALITY ASSURANCE

A. Single Source Responsibility: Laboratory furniture system, casework, work surfaces, laboratory equipment and accessories shall be manufactured or furnished by a single laboratory furniture company.

B. Manufacturer's Qualifications: Modern plant with proper tools, dies, fixtures and skilled workmen to produce high quality laboratory casework and equipment. Installers shall be factory certified by the manufacturers.

C. Coordination Drawings: The supplier / installer shall coordinate the installation of all products under the section, including mechanical, plumbing and electrical items, which are provided by the supplier and installed by other contractors. Laboratory casework manufacturer shall be responsible for generating layout drawings and distributing them to the mechanical, electrical and plumbing contractors for coordination and accurate locations of cutouts and service connections required by each discipline, prior to generating final shop drawings.

D. Owner has the right to inspect equipment at the manufacturer's factory prior to shipment. Equipment found not to be in conformance with requirements of the Contract Documents might be rejected.

E. Installer's Qualifications: Installer shall be factory certified by the manufacturer.

F. Structural performance requirements for metal casework: Completed casework shall meet the performance test requirements of load testing for steel casework, SEFA-8-M.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products on the site in such a manner as to minimize the risk of damage, decay, deterioration or loss from theft.

B. All products shall be delivered to the job site in manufacturer's original unopened containers, crates or protective wrappings with the manufacturer's name and addressed clearly labeled thereon.

C. Accept products on site and inspect on arrival for damage.

D. Protect product from damage of soiling at all times. Keep products covered with polyethylene film or other suitable protective coverings. Protect installed casework throughout construction period with corrugated cardboard completely covering the top and securely taped to edges. Mark cardboard in large lettering "No Standing".

1.8 PROJECT CONDITIONS

A. Do not deliver or install laboratory casework in the final work until building is secure and weather-tight, all painting is completed and ceilings, overhead ductwork and lighting are installed and HVAC systems are operational and capable of maintaining the building temperature and humidity at occupancy levels throughout the remainder of the construction period.

1.9 FIELD MEASUREMENTS

A. Verify field measurements shown on shop drawings or as instructed by manufacturer.

1.10 WARRANTY

A. Provide warranty under provisions of Division 1.

PART 2 - PRODUCTS

2.1 ACCEPTABLE PRODUCTS (Fixed Modular Lab Casework)

A. Subject to compliance with these specifications, acceptable products **are limited to** those manufactured and provided by the following companies. While this specification is based on Kewaunee Scientific Corporation, products by the other manufacturers listed below are considered equals provided they meet the standard of design and quality for materials, construction and workmanship as described in this specification.

1. **Kewaunee Scientific Corporation**:
   a. Fixed Modular Steel Lab Casework System: Full Flush Overlay
2. **Mott Manufacturing**:
   a. Fixed Modular Steel Lab Casework System: Full Flush Overlay
3. **Bedcolab:**
   a. Fixed Modular Steel Lab Casework System: Full Flush Overlay

B. Fixtures:

1. Watersaver Faucet Company
2. T&S Brass
3. Chicago Faucet

2.2 HARDWARE

A. Hardware and Trim:

1. Drawer and Door Pulls: Drawer and door pulls shall be modern design, offering a comfortable handgrip and be securely fastened to doors and drawers. Two pulls shall be required on all drawers over 30” long. Pulls to be stainless steel wire type.
2. Hinges: Hinges shall be the five (5) knuckle institutional, offset type for all swinging doors. Hinges shall be 2-3/4” long, one (1) pair for doors less than 4 ft. in height and 1-1/2 pair on doors over 4 ft. in height. Hinges are mounted with flathead screws, so applied to door and cabinet to withstand a weight load of 150 lbs. minimum. All hinges shall be satin finish stainless steel.
3. Locks: 5-pin locking system, heavy-duty cylinder type, capable of 75 pure key changes (unique keys) with master keyed system determined by Owner, heavy-duty cylinder type. Exposed lock noses shall be dull nickel (satin) plated and stamped with identifying numbers. Locks shall have capacity for 225 primary key changes. Master key one level with the potential of 40 different, non-interchangeable master key groups. The Contractor shall prepare a keying schedule based on the Owner’s requirements for all cabinetry locks. The keying schedule shall incorporate the following general requirements:
   a. Rooms: Each cabinet (if identified as locking on lab plans) to be uniquely keyed and master keyed.
   b. Lab Spaces: Each cabinet (if identified as locking on lab plans) shall be uniquely keyed and master keyed for the entire laboratory unit. Multiple locking drawers and doors within a single cabinet should be keyed alike.

c. Keys: Stamped brass available from manufacturer or local locksmith and supplied in the following quantities unless otherwise specified:

1) 2 – for each keyed different lock

2) 4 – for master keys for entire system

3) 2 – for each group keyed alike locks

4. Catches:

a. Steel and Stainless Steel Casework: Positive Catches to be used. Provide a two-piece heavy-duty cam action positive catch. The main body of the catch shall be confined within an integral cabinet top or divider rail, while latching post shall be mounted on the hinge side of the door. Polyethylene roller type catches are not acceptable.

5. Elbow Catches: When locks are specified, elbow catches shall be utilized. Elbow catches and strike plates shall be used on left hand doors of double door cases and are to be case aluminum with bronze finish.

6. Leg Shoes: Leg shoes shall be provided on all table legs, unless otherwise specified, to conceal leveling device. Shoes shall be 1-1/2" high and a pliable, black vinyl material. Use of a leg shoe which does not conceal leveling device will not be acceptable.

7. Floor Glides: Floor glides, where specified for movable open-leg tables, shall be a non-marring material at least 1" diameter to prevent indenting on composition flooring and shall have at least a 5/8" height adjustment. Use of metal buttons will not be acceptable.

8. Dowels used to join frames and panels shall be fluted hardwood not less than 3/8" in diameter.

9. Shelf Support Clips: Shelf support clips shall be double pin type for mounting on interior of cabinetwork. Clips shall be corrosion resistant and shall retain shelves from accidental removal. Shelves are adjustable on 32 mm centers. Surface mounted metal support strips and clips subject to corrosion are not acceptable.

10. Drawer Suspension: Full extension drawer slides with cushioned in and out stops.

a. Drawer Suspension: Drawer slides shall be as made by Accuride or approved equal approved prior to bid with a standard clear zinc finish.

1) Light duty, 24" wide or less: Ball bearing, rail mount, full extension +1" over travel slides, hold open detent with a 100 lb./pair load rating.

2) Heavy duty, 30" wide or more and all file drawers: Ball bearing, rail mount, full extension +1" over travel slides, hold open detent with a 200 lb./pair load rating and progressive movement.

11. Label Holders: Furnish and install label holders on each drawer and each hinged casework door. Label holders shall be Kewaunee part number F-0260-00 (Aluminum) or approved equal.

12. Seismic Lips: (If required per 1.4/C above) Wood casework: Furnish 3/16" x 2" clear Plexiglas (acrylic) lips at all open shelves. Metal casework: Furnish matching material/color metal lips at all open shelves.

2.3 FIXED MODULAR STEEL LABORATORY CASEWORK

A. Casework Design Requirements:

1. Full flush overlay steel construction

2. Maximum front width of end panels: 3/4"; Maximum front height of top and bottom members: 1"

3. Self-supporting Units: Completely welded shell assembly without applied panels at ends, backs or bottoms, so that cases can be used interchangeably or as a single, stand-alone unit
4. Interior of Case Units: Easily cleanable, flush interior. Base cabinets, 30" and wider, with double swinging doors shall provide full access to complete interior without center vertical post.
5. Drawers: Sized on a modular basis for interchangeability to meet varying storage needs, and designed to be easily removable in field without use of special tools.
6. Case Openings: Rabbeted-like joints on all four sides of case openings for hinged doors.
7. Framed Glazed Doors: Identical in construction, hardware and installation to solid panel doors. Design frame glazed doors to be removable for glass replacement.
8. Fillers, Scribes and Closures: Provide and install as necessary for a complete installation.

B. Casework Performance Requirements:

1. Structural Performance Requirements: Casework components shall withstand the following minimum loads without damage to the component or to the casework operation:
   a. Steel base unit load capacity: 500 lbs. per lineal foot.
   b. Suspended units: 300 lbs.
   c. Drawers in a cabinet: 150 lbs.
   d. Utility tables (4 legged): 300 lbs.
   e. Hanging wall cases: 300 lbs.
   f. Load capacity for shelves of base units, wall cases and tall cases: 180 lbs.
      1) Heavy Duty shelving for Ammo Storage: 100lbs per linier foot.
2. Metal Finish Performance Requirements:
   a. Abrasion Resistance: Maximum weight loss of 5.5 mg per 100 cycle when tested on a Taber Abrasion Tester #E40101 with 1000 gm wheel pressure and Calibrase #CS10.
   b. Hardness: Surface hardness equivalent to 4H or 5H pencil.
   c. Humidity Resistance: Withstand 1000-hour exposure in saturated humidity at 100ºF.
   d. Moisture Resistance:
      1) No visible effect to surface finish after boiling water trickled over test panel inclined at 45 degrees for five minutes.
      2) No visible effect to surface finish following a 100-hour continuous application of a water soaked cellulose sponge, maintained in a wet condition throughout the test period.
   e. Adhesion: Score finish surface of test panel with razor blade into 100 squares, 1/16" x 1/16", cutting completely through the finish but with minimum penetration of the substrate, and brush away particles with soft brush. Minimum 95 squares shall maintain their finish.
   f. Salt Spray: Withstand minimum 200-hour salt spray test.

C. Chemical Resistance Finish Performance Requirements:

1. Test Procedure: Apply 10 drops (approximately 0.5 cc) of each reagent identified to the surface to the finished test panels laid flat and level on a horizontal surface. Ambient temperature: 68ºF to 72ºF (20ºC to 22ºC). After one hour flush away chemicals with cold

water and wash surface with detergent and warm water at 150ºF (65.5ºC) and with alcohol to remove surface stains. Examine surface under 100 foot-candles of illumination.

2. Evaluation Ratings: Change in surface finish and function shall be described by the following ratings:
   a. Excellent: Indicates excellent to superior integrity of finish film. Includes no effect of slight change in gloss and slight discoloration.
   b. Good: Clearly discernible change in color or gloss. Finish remains intact and protective with no significant impairment to function or life.
   c. Failure: Obvious and significant deterioration, visible blistering, pitting, bare spots or roughness of surface.
3. Test Results (concentration by weight):

REAGENT	RATING
a. Acetic Acid, 93%	Excellent
b. Formic Acid, 33%	Good
c. Hydrochloric Acid, 37%	Excellent
d. Nitric Acid, 25%	Excellent
e. Nitric Acid, 60%	Good
f. Phosphoric Acid, 75%	Excellent
g. Sulfuric Acid, 28%	Excellent
h. Sulfuric Acid, 85%	Excellent
i. Ammonium Hydroxide, 10%	Excellent
j. Sodium Hydroxide, 10%	Excellent
k. Sodium Hydroxide, 25%	Excellent
l. Acetone	Excellent
m. Carbon Tetrachloride	Excellent
n. Ethyl Acetate	Excellent
o. Ethyl Alcohol	Excellent
p. Ethyl Ether	Excellent
q. Formaldehyde, 37%	Excellent
r. Hydrogen Peroxide, 5%	Excellent
s. Methylethyl Ketone	Excellent
t. Phenol, 85%	Good
u. Xylene	Excellent

4. Finish drawer bodies in matching or harmonizing color and apply corrosion-resistant treatment to selected, concealed interior parts.
5. Provide independent certified test report on chemical resistant finish.

D. Casework Materials:
   1. Sheet Steel: Mild, cold rolled and leveled unfinished steel.
   2. Minimum Gauges:

a. 20 gauge: Interior drawer fronts, scribing strips, filler panels, enclosures, drawer bodies, shelves, security panels and sloping tops.

b. 18 gauge: Case tops, ends, bottoms, bases, backs, vertical posts, uprights, glazed door members, door exterior panels, filler panels and access panels.

c. 16 gauge: Top front rails, top rear gussets, intermediate horizontal rails, table legs and frames, leg rails and stretchers.

d. 14 gauge: Drawer suspensions, door and case hinge reinforcements and from corner reinforcements.

e. 11 gauge: Table leg corner brackets and gussets for leveling screws.

3. Glass for glazed doors: 1/4" (6mm) thick clear tempered safety glass.

E. Casework Fabrication:

1. Base Units and Cases:

a. Base units and 25", 31" and 37" high wall cases: One piece end panels and back, wrap-around design, reinforced with internal reinforcing front and rear posts. Base units shall be 22" overall in depth.

b. 49" and 84" high cases: Formed end panels with front and rear reinforcing post channels; back shall be formed steel panel, recessed 3/4" for mounting purposes.

c. Posts: Front post fully closed with full height reinforcing upright. Shelf adjustment holes in front and rear posts shall be perfectly aligned for level setting, adjustable to 1/2" o.c.

d. Secure intersection of case members with spot and arc welds. Provide gusset reinforcement at front corners.

e. Base unit backs: Provide drawer units without backs and cupboard units with removable backs for access to services behind unit.

f. Bottoms: Base units and 25", 31", 37" and 49" high wall cases shall have one piece bottom with front edge formed into front rail, rabbeted as required for swinging doors and drawers.

g. Top rail for base units: Interlock with end panels, flush with front of unit.

h. Horizontal intermediate rails: Recessed behind doors and drawer fronts; removable for later revision in cabinet configuration.

i. Base for base units: 4" high x 3" deep with formed steel base and 11 gauge die formed steel gussets at corners. Provide 3/8" diameter leveling screw with integral bottom flange of minimum 0.56 sq. in. area at each corner, accessible through openings in toe space.

j. Tops of wall cases: One piece, with front edge formed into front rail.

k. Vertical service cores: Provide manufacturer's standard service core matching adjacent wood laboratory casework in color and finish. Coordinate free area within service core with related disciplines.

2. Drawers:

a. Drawer fronts: 3/4", double wall construction, pre-painted prior to assembly and sound deadened; top front corners welded and ground smooth.

b. Drawer bodies: Bottom and sides formed into one-piece construction with bottom and sides coved and formed top edges.

c. Provide drawer with rubber bumpers. Friction centering devices are not acceptable. Provide security panels for drawers with keyed different locks.

d. File drawers: Provide with full extension slides for full access and operation. Provide all file support inserts.

3. Doors:

a. Solid panel doors: 3/4" thick, double wall, telescoping box steel construction with interior pre-painted and sound deadened, all outer corners welded and ground smooth. Reinforce interior of front panel with welded steel hat channels. Secure hinges with screws to internal 14 gauge reinforcing in case and door. Hinges shall be removable; welding of hinges is not acceptable. Doors shall close against rubber bumpers.

b. Frame glazed doors: Outer head shall be one-piece construction. Inner head shall consist of top, bottom and side framing members, which are removable for installation or replacement of glass. Provide continuous vinyl glazing retainer to receive glass. In all other respects, framed glazed doors construction and quality shall match solid panel doors.

4. Shelves:

a. Form front and back edges down and back 3/4". Form end down 3/4". Reinforce shelves over 36" long with welded hat channel reinforcement the full width of shelf.

b. Pull-out shelves: Full extension slide.

c. All open shelving to have seismic lip edge restraints.

2.4 FLAMMABLE CHEMICAL AND ACID STORAGE CABINETS

A. General:

1. Applicable to freestanding cabinets where shown, and cabinets beneath fume hoods.

2. Flammable Chemical Storage Cabinet performance requirements shall be as previously noted for painted steel casework.

a. Maximum internal temperature: 325ºF, when subjected to a 10 minute fire test using standard time-temperature curve per ASTM E152-72 (Article 42, NFPA No. 30).

b. Reference Standards:

1) OSHA General Industry Standards Section 1910.106.

2) NFPA Flammable and Combustible Liquid Code No. 30.

3) Cabinets shall be Factory Mutual (FM) approved.

B. Acid Storage Cabinets: Acid Storage Cabinets shall utilize the same materials and construction features as other base cabinets, i.e. wood fronts where next to wood casework and stainless steel fronts when next to stainless steel casework. In addition, they shall have a one-piece liner insert made of linear low-density polyethylene that covers the entire inside surface of the cabinet. The liner insert shall be one-piece and form an integral one and one- half inch high pan at the bottom to retain spillage, except provide an easily removable 8" x 8" access panel in the back wall to gain access to the service chase behind the acid cabinet. Pieced installations are not acceptable. The door shall be lined with a polyethylene sheet. Each cabinet shall be vented with a 2" threaded vent connection pipe on the back of the cabinet for supply and exhaust ventilation air. Label cabinet: "ACID STORAGE".

1. Acid cabinets located under fume hoods shall be equipped with ventilation kits providing positive ventilation from the cabinet, bypassing the interior of the fume hood between the liner and the steel housing, and connecting directly to the exhaust duct transition piece above the fume hood or where indicated by the mechanical drawings.

2. Acid storage cabinets installed independent of fume hoods shall be provided with individual exhaust vents to be run to the exterior through the roof of the building to an exhaust fan. Ductwork and fan shall be by HVAC ductwork installer (Division 23).

3. Undercounter acid storage cabinets shall be furnished with one solid, removable polyethylene corrosion resistant shelf.

C. Flammable Chemical Storage Cabinets: Cabinets shall be specifically designed for the storage of flammable and combustible liquids. Construction shall be based upon the requirements listed by UFC, 18 gauge steel and shall be all double panel construction with a 1-1/2" air space between panels. Provide stainless steel construction when flammable chemical storage cabinets are next to stainless steel cabinetry. All joints shall be welded, or screwed, to provide a rigid enclosure. The doors shall swing on full-length stainless steel piano. The right hand door shall be equipped with a three point latching device and the left- hand door shall have a full height astragal. The doors are self-closing and synchronized so that both doors will always fully close. The right hand door is equipped with a three-point latching system that automatically engages when the doors close. Each door is equipped with a fusible-link hold-open feature that will ensure the door closes should the temperature outside the cabinet exceed 165 degrees Fahrenheit. Units 24" long have only one door, self- closing, and equipped with a three point latching system and hold-open feature. A 2" deep liquid tight pan that covers the entire bottom of the cabinet shall be furnished to contain liquid leaks and spills. Provide one adjustable shelf at counter height cabinets or under fume hoods. The shelf shall be perforated to allow air circulation within the cabinet. The cabinet shall have interior finish same as exterior. The unit shall be UL listed.

1. Top, bottom and sides: 18 gauge steel, double wall construction with 1-1/2" air space, removable access and back panels; all joints welded. Set bottom of door two inches above bottom of cabinet to create two-inch deep well to contain spillage of liquids.

   Hardware:

   a. 3 point latching device and lock
   b. Full length piano hinge
   c. Door operation: Self-closing with fusible link

2. Upper and Lower Arrestor Vents with Spark Screens: Factory Mutual approved vents located so that they can be plugged both internally and externally to assure isolation of stored fluid, but can be opened for ventilation means as required by applicable local codes.
3. Cabinet Grounding Attachment: Screw at base of cabinet for firm attachment of grounding wire.
4. Cabinet Finish, Color and Markings:

   a. Finish: Powder coated or urethane
   b. Cabinet color and markings shall be selected from the manufacturer's standard colors.
   c. Mark with Factory Mutual approval.
   d. Label cabinet: "FLAMMABLE – KEEP FIRE AWAY"

5. Sizes:

   a. Undercounter Flammable Chemical Cabinets: Width per drawings; Height to be the manufacturer's standard for undercounter applications.

6. ADA Base Cabinets – Special ADA Requirement:

   a. For use at fume hoods indicated in the drawings to be ADA compliant units.
   b. Provide base cabinets to locate work surface at a nominal 34" working height.
   c. Outer Base Cabinets: Acid storage units.
      1) Construct units to allow access for forwarded-mounted cupsink locations.
      2) Line cabinets with 1/4" thick acid resistant Portland cement fume hood liner.

3) Bypass vent cabinets as indicated in section titled 'Base cabinet ventilation' above.

4) Units shall contain a bottom tray on full extension guides to allow tray to be totally pulled out of unit for access. Tray shall support a 50-lb. load.

2.5 LABORATORY COUNTERTOP SURFACES & BACKSPLASHES

A. Provide and install countertops where shown on the drawings on lab cabinetry. Countertop fabricator shall drill all holes and make all cuts in countertop materials as required for the proper installation of all plumbing and electrical work.

1. Radiused Corners: All outside corners of all countertops shall have a finished 1/2" radius in plan.

2. Drip Groove: Provide continuous drip groove on underside of all countertops, 1/4" to 1/2" inboard of the front edge.

3. 1" thick backsplashes shall match countertops in material and color.

B. Epoxy Resin Countertop: Provide 1" thick epoxy resin countertops at all laboratory spaces and window sills in all lab spaces.

1. Subject to compliance with these specifications, acceptable products include, but are not limited to, those manufactured and provided by the following companies:

a. Durcon, Inc.

b. Kewaunee Scientific

c. American Epoxy

2. Material: Basis of Design: *Durcon Inc. Greenstone Environment friendly worksurfaces*. Chemical and abrasion resistant, durable top of one-inch thick cast material of epoxy resin and non-asbestos inert fillers, cast flat with a uniform color and low-sheen surface without surface coating application at all surfaces (tops, sides and ends), forming a thermosetting material with the following properties:

a.	Tensile Strength:	ASTM D651-48, 8,000 psi
b.	Compressive Strength:	ASTM D695-61T, 28,000 to 30,000 psi
c.	Flexural Strength:	ASTM D790-61, 17,000 to 18,000 psi
d.	Flexural Modulus:	ASTM D790-61, 2.2 x 10 to the 6th power psi
e.	Hardness:	ASTM D785-60T, Rockwell M, 107 to 110
f.	Density:	ASTM D792-50, 1.92g/cc
g.	Water Absorption:	ASTM D570-59, 0.02% in 24 hours
h.	Heat Distortion Temperature :	350ºF
i.	Thermal Expansion Coefficient:	2.02 x 10 to the minus 5th power in/in/ºF

3. Backsplashes: Same material as countertop, at heights shown on the drawings, butt jointed and cemented to top. Provide where indicated on drawings. Include end splash where top abuts end wall or panel. Do not restrict access panels and provide architect approved method of attachment.

4. Epoxy Resin Edge: All edges shall be beveled with a 3/16" bevel, and polished to match the finish of the epoxy top.

5. Epoxy Resin Cord Slot (**CS**) – Provide 12" long (or as noted on plan) x 2-1/2" wide hole in epoxy resin countertop. Ends shall be 1-1/4" radiused. All edges shall be beveled.

6. Epoxy Resin Color: Shall be selected by the Architect from the manufacturer's complete line of colors, including light gray and other color options manufactured by Durcon,

Kewaunee or equal products with a similar color by other manufacturers. Color of epoxy resin countertops in fume hoods shall match adjacent countertops.

7. Work Surface Performance Requirements (Factory Test):
   a. Test Procedure: Apply five drops of each reagent to surface and cover with 25mm watch glass, convex-side down; Test volatiles using one ounce bottle stuffed with saturated cotton. After 24-hour exposure, flush surface, clean, rinse and wipe dry.
   b. Evaluation Ratings: Change in surface finish and function shall be described by the following ratings:
      1) No Effect: No detectable change in surface material.
      2) Excellent: Slight detectable change in color or gloss, but no change to the function or life of the work surface material.
      3) Good: Clearly discernible change in color or gloss, but no significant impairment of work surface function or life.
      4) Fair: Objectionable change in appearance due to surface discoloration or etch, possibly resulting in deterioration of function over an extended period.
      5) Failure: Pitting, crating or erosion of work surface material; Obvious and significant deterioration.
8. Test Results:

REAGENT		RATING
a.	Acetic Acid, 98%	Excellent
b.	Acetone	Excellent
c.	Acid Dichromate	Fair
d.	Ammonium Hydroxide, 28%	No Effect
e.	Amyl Acetate	Excellent
f.	Benzene	Excellent
g.	Butyl Alcohol	No Effect
h.	Carbon Tetrachloride	No Effect
i.	Chloroform	Excellent
j.	Chromic Acid, 60%	Failure
k.	Cresol	Excellent
l.	Dichloro Acetic Acid	Good
m.	Dimethylformanide	Excellent
n.	Dioxane	Excellent
o.	Ethyl Acetate	No Effect
p.	Ethyl Alcohol	No Effect
q.	Ethyl Ether	Excellent
r.	Formaldehyde	No Effect
s.	Formic Acid, 90%	Excellent
t.	Furfural	Good
u.	Gasoline	No Effect

v.	Hydrochloric Acid, 37%	Excellent
w.	Hydrofluoric Acid, 48%	Fair
x.	Hydrogen Peroxide, 5%	No Effect
y.	Methyl Alcohol	No Effect
z.	Methyl Ethyl Ketone	Excellent
aa.	Methylene Chloride	Excellent
bb.	Mono Chlorobenzene	Good
cc.	Naphthalene	Excellent
dd.	Nitric Acid, 20%	Excellent
ee.	Nitric Acid, 30%	Excellent
ff.	Nitric Acid, 70%	Good
gg.	Phenol	Excellent
hh.	Phosphoric Acid, 85%	No Effect
ii.	Silver Nitrate	No Effect
jj.	Sodium Hydroxide, 10%	No Effect
kk.	Sodium Hydroxide, 20%	No Effect
ll.	Sodium Hydroxide, 40%	No Effect
mm.	Sodium Hydroxide Flake	No Effect
nn.	Sodium Sulfide	Excellent
oo.	Sulfuric Acid, 33%	No Effect
pp.	Sulfuric Acid, 77%	No Effect
qq.	Sulfuric Acid, 96%	Failure
rr.	Tincture of Iodine	Excellent
ss.	Toluene	Excellent
tt.	Trichloroethylene	Excellent
uu.	Xylene	No Effect
vv.	Zinc Chloride	No Effect

2.6 LABORATORY SINKS

A. Provide laboratory sinks complete with overflows, sink outlets and tailpieces. P-Traps, supplies and valves to be provided by Division 22, plumbing subcontractor. Lab casework contractor shall set sink, but all other final plumbing installation and connection shall be by Division 22. Lab sinks are indicated in the drawings on the lab casework.

B. Epoxy Resin Sinks: Integrally molded from modified thermosetting epoxy resin, specially compounded and oven cured and set with epoxy cement. Color shall match the adjacent countertop. Drop in units will be acceptable. Physical properties shall be as described for epoxy resin countertops. Cove inside corners and pitch bottom to threaded drain outlet.

1. Size: Reference Lab Sink Schedule on sheet L100.
2. Location: All sinks shown in epoxy resin countertops.
3. Drain location: Per Manufacturer.

4. Tailpiece: Compatible with drain piping. Color to match sink.
5. Color: Match adjacent epoxy resin countertops.
6. Faucet ledge to be at rear of sink with deck mounted horizontal paddle arm style hand controls located 4" to either side of faucet. Deck mounted eyewash units shall be located per manufacturer's recommendations.
7. Subject to compliance with these specifications, acceptable products include, but are not limited to, those manufactured and provided by the following companies:
    a. Durcon, Inc.
    b. Kewaunee Scientific
    c. American Epoxy

C. Sink Supports:

1. Cabinet sinks: Support sinks on 11 gauge, adjustable, 1" x 2" x 1" channel with reagent resistant finish. Provide two channels across width of cabinet, attached to 3/8" diameter threaded hanger rods.

2.7 LABORATORY EPOXY RESIN DRYING RACKS (PEGBOARDS) (**ED1**)

A. Drying Racks:

1. Board: Epoxy resin board finished on face and edges. Where exposed, finish back with slightly different surface texture and bevel bottom edges.
2. Pegs: Polypropylene pegs in 5", 6-1/2" and 8" lengths with glassware protector base. Base of pegs shall be two-prong style for mechanical attachment. Do not bond pegs to board.
3. Drip Trough: Provide with drip trough the full width of the base of pegboard unit, with drain hole fitted with rubber tubing to laboratory sink.
4. Size and Quantity of Pegs:
    a. **ED1**: 18"w x 36"h with approximately 32
5. Color: Match adjacent epoxy resin countertops.
6. Location: Locate the drying racks to avoid conflicts with deck mounted eyewash units. The drying rack shall be no closer than 14" from the eyewash unit.

2.8 LABORATORY PLUMBING & ELECTRICAL FITTINGS

A. General:

1. Products shall be Watersaver – Colortech series or other manufacturers listed in Section 2.1, or other equal products manufactured by other manufacturers. Minor differences from these specifications in the design, manufacturing techniques and appearance of the products offered by the approved manufacturers are acceptable.
2. All fixtures shall be warranted for a period of two years after date of occupancy. All laboratory service fixtures shall be the product of one service fixture manufacturer to ensure uniform appearance and ease of maintenance.
3. All service fittings shall be factory assembled (including the assembly of valves and shanks to turrets, flanges and other mounting accessories), and each fixture shall be individually factory tested. All fixtures shall be designed to minimized exposed surfaces on which dust, dirt and airborne contaminants may collect, and to facilitate cleaning and maintenance of the service fixture. Faucet and valve handles shall be hooded to cover the valve stem and top surface of the packing nut or bonnet. The valve stem shall not be exposed to view as the faucet or valve is opened and closed.

4. Installation: Lab casework contractor shall furnish all laboratory plumbing and electrical fittings specified, but these shall be turned over to the Division 22, 23 and 26 contractor for installation.

B. Finish:

1. Chrome: All laboratory service fittings and emergency eyewash and shower equipment shall be furnished with a chrome-plated finish with clear epoxy coating. All exposed surfaces shall be polished and buffed, then electroplated with one layer of nickel and one layer of chrome. Following plating, clear epoxy coating shall be applied to all exposed surfaces and then baked to permit curing. Surfaces shall have a minimum thickness of 2 mils.

2. Performance: All coating material shall meet the following tests for chemical resistance:

a. Fume test: Suspend coated samples in a container at least 6 CF capacity approximately 12" above open beakers, each containing 100 cc of 70% nitric acid, 94% sulfuric acid and 35% hydrochloric acid, respectively. After exposure to these fumes for 15 hours, the finish on the samples shall show no discoloration, disintegration or other effects.

b. Direct application test: Subject coated samples to the direct action of the following reagents and solvents at a temperature of 25ºC dropping from a burette at a rate of 60 drops per minute for 10 minutes.

Acetone, Carbon Tetrachloride, Ethyl Alcohol, Glacial & Acetic Acid	99.5%
Hydrochloric Acid	38%
Mineral Oil, Nitric Acid	70%
Sodium Hydroxide	50%
Sulfuric Acid, Toluene & Zinc Chloride-Saturated	92%

Finish on samples shall not rupture, though slight discoloration or possible softening is possible.

C. Water Service Fittings: Provide deck mounted plumbing service fittings at laboratory sinks as follows:

1. The water faucets and valves shall be fully assembled and individually tested at the factory. Fixtures shall be factory tested at 100 psi to withstand 80 psi working pressure. Water service faucets and valves shall have renewable unit containing all working parts subject to wear, including replaceable stainless steel seat. All water service fixtures shall meet the requirements of ANSI/ASME A112.18.1M-1989 and be certified by CSA under standard CAN/CSA B.125.M89.

2. Goosenecks shall have a separate outlet coupling with a 3/8" IPS female thread securely brazed to the gooseneck for attachment of serrated hose ends, aspirators and other outlet fittings. Provide each rigid gooseneck with standard aerator type of fitting installed on each faucet. Additionally, provide one loose 3/8" IPS male inlet thread that the Owner can use in the future to be threaded directly into the faucet.

3. Provide vacuum breakers integral with the gooseneck. Vacuum breakers shall have a forged brass body, a renewable seat and an ultralight float cup with a silicone gasket for fine flow control. Vacuum breakers shall not spill over at low water volume. Vacuum breakers shall be certified by ASSE under standard 1001.

4. Handles: All water fittings shall be provided with separate deck mounted faucets with horizontal acting wrist blade handles conforming to ADA Accessibility Standards. Faucet design shall be compatible with the foot pedal water delivery system specified in this section.

5. Lab Sink Fittings as Scheduled: Faucets shall be provided with hands free operation at locations as indicated in the Laboratory Sink Schedule, either foot pedal operated or infrared operated as scheduled.

    a. Foot pedal operated faucets: Provide model # CT2224TWI-8VBL3001LP with integral vacuum breaker as manufactured by Watersaver-Colortech or equal products by other manufacturers. Refer to plumbing drawings for plumbing work associated with piping. All sinks with hands free devices shall also have standard faucets to enable persons to manually adjust hot and cold water temperature. Lab casework manufacturer shall coordinate and prep all casework as required for the installation of foot pedal fittings and plumbing. Deck mounted water fittings with the foot pedal operation shall match the appearance of those at other locations. Provide with deck mounted 4" blade handles and 8" goosenecks with vacuum breakers and standard aerator. Provide painted steel cover over the exposed piping within the sink base cabinet to conceal the exposed piping.

    b. Infrared operated faucets: Provide model # CTS400-8VB-BH as manufactured by Watersaver-Colortech, with transformer that plugs into an electrical outlet under the counter, or equal products by other manufacturers. Refer to plumbing drawings for plumbing work associated with piping. All sinks with hands free devices shall also have standard faucets to enable persons to manually adjust hot and cold water temperature. Lab casework manufacturer shall coordinate and prep all casework as required for the installation of foot pedal fittings and plumbing. Deck mounted water fittings with the infrared operation shall match the appearance of those at other locations. Provide with deck mounted 4" blade handles and 8" goosenecks with vacuum breakers and standard aerator. Provide mixing valve at hot/cold tee inlet prior to solenoid valve.

    c. Standard Sink Faucets: Provide deck mounted mixing faucet with deck mounted 4" blade handles and 8" swinging goosenecks with vacuum breakers. Provide model # CT2224-8VB with integral vacuum breaker as manufactured by Watersaver-Colortech, or other manufacturers. Provide standard aerator type of fitting on each faucet. Provide spare barbed tip.

D. Combination Emergency Eyewash / Shower Units **(EWS)**:

1. Combination emergency shower / eyewash units:

    a. Swing Down Recessed eyewash and emergency showers with eyewash drain pan: Watersaver model # SSBF2150 Stainless Steel finish with polished chrome plated brass shower supply nipple, where swing down units are called for, **pipe eyewash pan drainage to fully concealed sanitary waste system**. Do not discharge eyewash on to floor!

2. Provide units where shown in the lab drawings. All units shall comply with ADA for handicap accessibility. Provide all signage required by ANSI and OSHA. Water flow from units shall comply with ANSI Z358.1. Unit shall be capable of being operated by both hand and foot devices.

3. Body shower component of the combination shower/eyewash shall provide sufficient flow with correct dispersion. The operating system is to be a stay-open-ball-valve with rod operation. The ball valve is to be replaceable without dismantling the entire shower. Each shower shall be supplied with an international approved emergency symbol for easy identification as required by the Federal Occupational Safety and Health Administration. Showers to be tested at a minimum pressure of 100 psi before leaving the factory. The base floor flange shall have 3 holes for secure mounting. Provide tailpiece assembly for the eyewash drain outlet, sized and configured to drain into the floor drain, and constructed of material matching the eyewash/shower unit.

4. Eyewash component of the combination shower/eyewash unit shall have a self-regulating flow control, a filter to remove debris from the water, and an integral flip-top dust cover. The operating system is to be a hand activated push “stay-open-ball-valve”. Eye washes to have a built-in ball valve or to be provided with a loose ball valve for correct flow regulation.
5. All mixing valves shall be provided by Division 22.
6. Waste connections for EWS are concealed in wall.

E. Deck Mounted Drench Hose Eyewash Units (**EW**):

1. Watersaver model # CTEW1022BP (@ right hand of sink). Provide deck mounted drench hose eyewash units at lab sinks, where indicated, with in-line vacuum breaker. Unit shall have 2 gentle spray outlet heads. Provide all signage required by ANSI and OSHA. The design of these units and their water flow, shall comply with ANSI Z358.1 for dedicated eyewash equipment. All mixing valves shall be provided by Division 22.
2. Locate eyewash unit on right hand of sink, rotated 45º towards sink.

F. Color Coded Handles for Service Fittings, Faucets and Controls: Provide faucet and service fittings with color coded hooded handles, with entire removable screw-on type plastic discs with letter stamped on disc in contrasting color as scheduled below:

SERVICE	HANDLE COLOR	DISC LETTERS
1. Cold Water	Dark Green	CW
2. Hot Water	Red	HW

G. Electrical Fixtures and Fittings: Lab casework manufacturer shall coordinate location of and prep all casework for installation of multi-outlet assemblies and other electrical work specified under Division 26. All electrical work shall be by the electrical subcontractor. Material and installation shall be in strict adherence with the current edition of the National Electric Code of the National Fire Protection Association, and with requirements of all local regulatory authorities. All outlets must be grounded.

1. Flush boxes: Galvanized steel, for duplex outlets.
2. Task Lights: Specified by Division 26, provided by electrical contractor and delivered to the laboratory casework installer for on-site setting of fixture to underside of upper cabinetry. All wiring to be performed by the electrical contractor as specified by Division 26.

2.9 LABORATORY CASEWORK ACCESSORIES

A. Cord Hole Grommet **(CG)**: Provide cord grommet with a flange projecting 1/4” onto surrounding counter surface.

1. Manufacturer: Rockler
2. Model: 91017, Black
3. Size: 3”Ø Overall, 2-1/2” hole size, 7/8” slot size, 5/8” depth

B. Key Case Cabinet: Provide manufacturer’s standard wall mounted metal key cabinet. Provide cabinet with capacity for 90 key hooks and number tags with single key access. Size: 17 3/4”w x 3”d x 11”h. Locate per Owner’s direction.

C. Knee Space Support Frame: (**KSF**)

1. Provide and install custom knee space support frames as detailed in lab drawings and located on lab plans.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify all equipment rough-in conditions and requirements.

B. Coordinate with other trades for the proper and correct installation of plumbing and electrical rough-in, structural backing for items attached to walls and for rough opening dimensions required for the installation of products in this section.

C. Examine substrate surfaces and associated work and conditions under which work will be installed. Do not proceed until unsatisfactory conditions have been corrected in a manner complying with the Contract Documents and acceptable to the Installer. Starting of work within a particular area will be construed as installer's acceptance of surface conditions.

3.2 INSTALLATION

A. General Requirements:

1. Install in accordance with manufacturer's instructions.
2. Install in accordance with standards required by the governing codes.
3. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.
4. Touch-up minor damaged surfaces caused during installation. Replace damaged components as directed by Architect.
5. Equipment in this section shall be installed with all necessary fittings mounted for final connection by Divisions 22, 23 and 26.

B. Casework Installation:

1. Install plumb, level, true and straight with no distortions. Shim as required, using concealed shims. Where laboratory casework abuts other finished work, scribe and apply filler strips for accurate fit with fasteners concealed where practical.
2. Base cabinets: Set cabinets straight, plumb and level. Adjust set tops within 1/16" of a single plane. Fasten each individual cabinet to floor at toe space, with fasteners spaced 24" o.c. Bolt continuous cabinets together with joints flush, tight and uniform, and with alignment of adjacent units within 1/16" tolerances. Secure individual cabinets with not less than 2 fasteners into floor, where they do not adjoin other cabinets.
3. Secure wall cabinets to solid supporting members, such as wall studs with concealed wall blocking, CMU, etc.
4. Abut top edge surfaces in one true plane. Provide flush joints not to exceed 1/8" between top units.

C. Countertop Installation (non-stainless steel):

1. Where required due to field conditions, scribe to abutting surfaces.
2. Field jointing: Only factory prepared field joints, located per approved shop drawings, shall be permitted. Secure joints in field, where practicable, in same manner as in factory, with dowels, splines, adhesives, or fasteners recommended by manufacturer. Locate field joints as shown on accepted shop drawings, factory prepared so there is no jobsite processing of top and edge surfaces.
3. Secure work surfaces to casework and equipment components with material and procedures recommended by the manufacturer.
4. Fastenings: Use concealed clamping devices for field joints, except for natural stone, composition stone and epoxy tops, located within 6" of front, at back edges and at intervals

not exceeding 24". Tighten in accordance with manufacturer's instructions to exert a constant, heavy clamping pressure at joints. Except for natural stone, composition stone and epoxy tops, secure tops to cabinets with "Z" type fasteners or equivalent, using 2 or more fasteners at each front, end, and back.

a. For epoxy resin countertops, secure to cabinets with epoxy cement applied at each corner and along perimeter edges of not more than 48” o.c.

5. Flatness: All installed countertops shall have a flatness of no more than 1/16” per 6 linear feet of run. All countertops shall be examined for flatness prior to installation and those that cannot meet this level of flatness shall be replaced by the contractor. Shims shall not exceed 1/8”.

6. Workmanship: Abut top and edge surfaces in one true plane, with internal supports placed to prevent any deflection. Provide flush hairline joints in top units using clamping devices. At joints, use manufacturer's recommended adhesives and holding devices to provide joint widths not more than 1/16" wide at any location, completely field and flush with abutting edges.

a. Where necessary to penetrate tops with fasteners, countersink heads approximately 1/8” and plugholes flush with material equal in chemical resistance, color, hardness and texture to top surface.

b. After installation, carefully dress joints smooth, remove any surface scratches, clean and polish surface.

c. Provide holes and cutouts as required for mechanical and electrical service fixtures.

d. Provide scribe mountings for closures at junctures of top, curb and splash with walls as recommended by manufacturer for materials involved. Use chemical resistant, permanently elastic sealing compound where recommended by manufacturer.

D. Sink Installation:

1. Sinks that were not factory installed shall be set in chemical resistant sealing compound and secured and supported per manufacturer’s recommendations.

E. Accessory Installation: Install accessories and fittings in accordance with manufacturer’s recommendations. Turn screws to seat flat; do not drive.

3.3 FIELD QUALITY CONTROL

A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities.

B. Tests and Inspections:

1. Perform each visual and mechanical inspections.

2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

3. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Emergency plumbing fixtures and water tempering equipment will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust operating equipment, with the exception of air-moving equipment, to efficient operation for its intended use, and as required by the manufacturer.

B. Make final adjustments to laboratory casework, including doors, drawer hardware, fixtures and other moving or operating parts to ensure proper and smooth operation.

C. Adjust fixtures, accessories and other moving or operating parts to function smoothly.

3.5 CLEANING

A. Clean equipment, casework, countertops and all other surfaces as recommended by the manufacturer, rendering all work in a new and unused appearance. Touch up as required.

B. Clean adjacent construction and surfaces which may have been soiled in the course of installation of work in this section.

C. Clean countertops with diluted dishwashing liquid and water leaving tops free of all grease and streaks. Use no wax or oils.

3.6 PROTECTION OF FINISHED WORK

A. Provide all necessary protective measures to prevent exposure of equipment and surfaces from exposure to other construction activity.

B. Advise general contractor of procedures and precautions for protection of material and installed equipment and casework from damage by work of other trades.

END OF SECTION 12 35 53

SECTION 22 00 10

BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Basic Plumbing Requirements specifically applicable to Division 22 Sections, in addition to Division 01 - General Requirements.

1.02 DESCRIPTION

A. Furnish materials and perform labor required to execute this work as indicated on the drawings, as specified and as required to complete the work of this section, except as otherwise herein specifically excluded.

1.03 REFERENCES

A. Section 23 08 01 - Commissioning of Building Systems

1.04 WORK INCLUDED

A. The complete Plumbing systems (including Fire Protection systems), including but not limited to these major items.

1. Coordinate work of this Section with related trades.
2. Verify applicable dimensions at the jobsite.
3. Furnishing and installation of miscellaneous hangers, supports, sleeves, inserts, anchors and other auxiliary equipment for systems under this Division.
4. Soil waste and vent system inside and outside the building including connections to fixtures, equipment, sewer connections, clean-outs.
5. Water piping systems inside and outside the building, including connections to fixtures, equipment, water meters and vaults; pressure regulating stations, backflow preventers.
6. Interruptible and non-interruptible fuel gas systems inside and outside the building, including connections, gas meters, earthquake valves, and pressure regulating stations.
7. Plumbing fixtures, carriers, fittings, trim, hose bibs, wall hydrants, and accessories.
8. Installation and connection of Owner furnished equipment.
9. Natural gas piping system including connections to equipment and site.
10. Water heating systems, including water heating equipment, circulating pumps, connections.
11. Shop drawings.
12. Equipment identification.
13. Equipment and systems adjustments and balancing.
14. Air, water and gas systems testing, adjusting and balancing.
15. Written operating and maintenance instructions.
16. Record drawings.
17. Guarantee

1.05 WORK SPECIFIED ELSEWHERE

A. Concrete, Architectural Sheet Metal, Door and Exterior Wall Louvers, Painting and Electrical.

1.06 SITE INSPECTION

A. Contractor shall familiarize himself with the conditions at the site. No allowance will be made subsequently for any error through negligence in observing the site conditions. Contractor shall observe and make cost allowance for any mechanical and/or electrical items that must be relocated to accommodate the installation or servicing of any item covered under this contract.

1.07 ORDINANCES, REGULATIONS AND CODES

A. References to Technical Societies, Trade Organizations, Governmental Agencies is made in Division 15 in accordance with the following abbreviations.

1. AFI - Air Filter Institute
2. AMCA - Air Moving & Conditioning Association
3. ARI - Air Conditioning & Refrigeration Institute
4. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers
5. ASME - American Society of Mechanical Engineers
6. ASTM - American Society of Testing Materials
7. AWSC - American Welding Society Code
8. ANSI - American National Standards Institute
9. CBC - California Building Code
10. CCR - California Code of Regulations
11. CEC - California Electrical Code
12. CFC - California Fire Codes
13. CMC - California Mechanical Code
14. CPC - California Plumbing Code
15. FIA - Factory Insurance Association
16. NAFM - National Association of Fan Manufacturers
17. NEMA - National Electrical Manufacturer's Association
18. NFPA - National Fire Protection Association
19. ORS - Office of Regulatory Services
20. SCAQMD - South Coast Air Quality Management District
21. SMACNA - Sheet Metal and Air Conditioning Contractors National Association
22. UFC - Uniform Fire Code
23. UL - Underwriter's Laboratories
24. UPC - Uniform Plumbing Code

B. Requirements of Regulatory Agencies: Materials and installation shall comply with applicable local, state, and national codes and ordinances. Rulings and interpretations of the enforcing agencies shall be considered as part of the local codes. No extras will be permitted for furnishing items required by the local codes but not specified or shown on the drawings.

C. Codes and Standards:

1. UBC and California Amendments (California Building Code - Part 2, Title 24, CCR).
2. UMC and California Amendments (California Mechanical Code - Part 4, Title 24 CCR).
3. UPC and California Amendments (California Plumbing Code - Part 5, Title 24 CCR).
4. Uniform Fire Code with State Amendments (California Fire Code - Part 9, Title 24 CCR).
5. National Fire Protection Associations - National Fire Code.

D. Nothing in these drawings and specifications is to be construed to permit work in violation thereof. Ordinances, regulations and codes are to be construed as minimum requirements.

E. The responsibility of the Architect to conduct construction reviews of the Contractor's performance is not intended to include the adequacy of the Contractor's safety measures in, on, or near the construction site.

F. Ventilating, refrigeration and electrical equipment and appliances are required to be approved by the Underwriters' Laboratories, Inc., or other nationally recognized testing agency and installed per the testing agency's specifications.

1.08 PERMITS, FEES AND INSPECTIONS

A. Obtain and pay for all necessary permits, fees, assessments, complimentary drawings, required by any legally constituted public authorities having jurisdiction.

1.09 DRAWINGS AND SPECIFICATIONS

A. The Architect's decision will be final on interpretation of the Drawings and Specifications.

B. The Drawings and Specifications are complimentary. Any work called for on the Drawings and not mentioned in the Specifications, or vice versa, shall be performed as though fully set forth in both.

C. Piping, ductwork and other equipment shown as existing has been taken from the Owner's drawings. Contractor shall verify exact location in field before proceeding with the work.

D. Where codes, standards, drawings or specifications conflict, the most stringent shall prevail, unless prior approval for variance is obtained. Specific details on the drawings shall supersede the specification in the event of a conflict.

E. Alternate support or seismic detail shall have prior approval by the Architect; and the Contractor shall obtain agency approval without any additional cost or time to the contract and without any time penalty on the work schedule.

1.10 SUBMITTALS

A. Before starting work, the Contractor shall furnish for the approval of the Architect, Shop Drawings and Submittals with Itemized Equipment Lists, complete in all details that they proposes to install. All items shall be submitted at the same time.

B. Submittals must be specific to this project with respect to model number, capacities, performance, etc., generic submittals will not be accepted.

C. Variations or deviations on submitted items from that specified must be clearly tagged and / or identified

D. Submittals shall include, but not necessarily be limited to the following which are mandatory:

1. Draw Equipment Layouts to ¼” scale, including equipment, piping accessories, and showing clearances for operating and servicing.
2. Schedule of pipe, fittings, valves, with manufacturer and catalog number.
3. Specialties, valves, gauges and thermometers of all types.
4. Foundations, supports, hangers, inserts.

5. Earthquake supports and calculations.
6. Expansion loops, expansion joints, guides, and anchors.
7. Insulation.
8. Ventilation and air conditioning equipment, specialties and the air control systems.
9. Shop fabrication drawings and installation drawings of ductwork and piping layouts. Submit for approval prior to fabrication. Drawings shall indicate dimensions from bottom of piping and ductwork to finish floor level.
10. Wiring diagrams, control panel board, motor starters and controls for electrically operated equipment furnished by mechanical trades.
11. Automatic control system diagrams.
12. Access panels.
13. Clean-outs
14. Fixture carriers.
15. Hangers, inserts, supports, anchors.
16. Hose bibs.
17. Hot water circulators.
18. Pipe, fittings and specialties.
19. Pipe isolators.
20. Plumbing fixtures, fittings, trim, drains and receptors.
21. Pressure regulators.
22. Roof flashing.
23. Sleeves, escutcheons, caulking, waterproofing, fireproofing.
24. Strainers
25. Water hammer arrestors.
26. Water heating equipment.
27. Expansion joints, guides and anchors.
28. Shop fabrications drawings and calculations.
29. Special and miscellaneous products furnished under this section and not listed herein.

1.11 RECORD DRAWINGS AND MANUALS

A. Record Set During the Work: At site, maintain at least one set of Drawings as a Field Record Set. Also maintain at least one copy of all Addenda, Modifications, approved submittals, correspondence, and transmittals at site. Keep Drawings and data in good order and readily available to Architect and Owner.

B. Changes: Clearly and correctly mark Record Drawings to show changes made during the construction process at the time the changed work is installed. No such changes shall be made in the work unless authorized by the Architect.

C. Final Record Drawings: Conform to Division 1 requirements.

D. Preparation of Final Record Drawings: Contractor shall transfer recorded changes in the work indicated on the Field Record Set to the record set. Changes shall be neatly and clearly drawn and noted by skilled draftsmen, and shown technically correct.

E. Approval: Prior to Architect's inspection for Substantial Completion, submit the Final Record Drawings to the Architect for review, and make such revisions as may be necessary for Final Record Drawings to be a true, complete, and accurate record of the work.

F. Manuals: Obtain data from the various manufacturers and submit instruction, operation, and maintenance manuals as required and to the extent required under other Sections.

G. Contents: Each manual shall have an index listing the contents. Information in the manuals shall include not less than:

1. General introductions and overall equipment description, purpose, functions and simplified theory of operation.
2. Specifications
3. Installation instructions, procedures, sequences, and precautions, including tolerances for level, horizontal and vertical alignment.
4. Grouting requirements.
5. List showing lubricants for each item of mechanical equipment and recommended lubrication intervals.
6. Start-up and beginning operation procedures.
7. Operational procedures.
8. Shutdown procedures.
9. Maintenance and calibration procedures
10. Parts lists
11. Name, address and telephone number of each manufacturer's local representative.

H. Manual Submittals: Unless otherwise specified, each submittal shall include two copies of each manual, one of which will be returned to the Contractor, marked to show the required review. When approved, deliver four copies to Architect unless otherwise specified.

I. “As-Built” drawings of ductwork and piping, including all elbows, transitions, damper and valve locations shall be provided prior to commencement of air and water balance.

1.12 QUALITY OF EQUIPMENT, MATERIALS AND WORKMANSHIP

A. Unless otherwise specified, equipment and materials used in the installation shall be new and in perfect condition when installed. Articles provided for the same general purpose or use shall be of the same make. Workmanship shall be of the best quality and none but competent mechanics skilled in their trades shall be employed. Furnish the services of an experienced superintendent, who shall be constantly in charge of the work, together with all necessary journeymen, helpers and laborers required.

1.13 SEISMIC DESIGN

A. Contractor shall be responsible for anchors and connections of mechanical work to the building structure including calculations for approval by structural engineer or for approval by inspector of record, as applies, for items or work, where approval is deferred or where alternate support or anchorage detail is proposed to prevent damage as a result of an earthquake, including manufactured equipment, the connection and integrity of shop fabricated and field fabricated materials and equipment. The anchorage of all pipes, ducts, conduits, fixtures, equipment, etc. shall withstand the lateral forces and shall accommodate calculated building displacement as required by the California Building Code, and local city/county codes. (Building equipment and connections therefore shall be designed to resist lateral seismic forces equal to 1.0 of equipment weight to working allowable stress. Cantilever posts supporting equipment shall be designed to resist lateral seismic forces equal to 0.5 of equipment weight to allowable working stress. Conform to the following:

1. In accordance with Title 24, 2016 CBC Chapter 16, details shall be provided for the seismic anchorage of all mechanical and electrical equipment, anchorage details shall be based upon appropriate design calculations.

2. For equipment weighing 400 pounds or more anchorage details and appropriate design calculations shall be submitted as part of the mechanical and electrical drawings. "Deferred Approval" items will not be permitted unless specifically approved by the plan check supervisor.

    a. Exception: Attachments of equipment weighting less than 400 pounds and supported directly on the floor or roof structure, furniture, or temporary or movable equipment and equipment weighing less than 20 pounds that is supported by vibration isolation devices suspended from the roof, wall or floor, need not be detailed on the plans provided the following notes are included on the mechanical and electrical plans.

3. The seismic anchorage of mechanical and electrical equipment shall conform to C.C.R. Title 24, 2016 CBC Chapter 16. Anchorage details for roof/floor-mounted equipment shall be shown on plans.

1.14 SUBSTITUTIONS AND CHANGES

A. The design has been based on data from certain manufacturers, suitable for each application. Recommendations for alternative manufacturers are made for each product, except when "no substitutions permitted" is indicated.

B. It is the intent of the Owner to have this project constructed with materials, products and system originally designed and specified into the project.

C. Alternatives that may require the modification, realignment and/or adjustment of other associated components, including impact on other trades, shall be accomplished at no additional cost or time to the contract and shall have the approval of the Architect.

D. Substitutions shall be submitted addressing all features listed in the specifications. Features that deviate from the plans and specifications shall be clearly identified including justification for deviations. Design West Engineers will review initial submittal on substitutes only. Subsequent submittals made to correct deficiencies in original submittals will be reviewed at Contractor's expense based on Design West Engineer's hourly rate for engineering services.

E. Should the Contractor elect to propose substitutions for the Owner's interest, the substitutions shall be in compliance with Division 01.

1.15 APPROVALS

A. The Architect will have the right to accept or reject equipment, materials, workmanship, tests and determine when the Contractor has complied with the requirements herein specified.

1.16 SELECTION AND ORDERING OF EQUIPMENT AND MATERIALS

A. Immediately after award of the Contract and after the approval of submittals by the Architect, the Contractor shall arrange for the purchase and delivery of equipment and materials required, in ample quantities and at the proper time. He shall deliver to the Architect a complete list of equipment and materials ordered, giving descriptions, plate numbers, brochures, name of the wholesalers, date of the orders and approximate delivery dates.

1.17 LOCATIONS AND ACCESSIBILITY

A. Drawings show pipe and ductwork diagrammatically. Conform to Drawings as closely as possible in layout work. Vary run of piping, run and shape of ductwork and make offsets during progress of work as required to meet structural and other interferences as approved by Architect. Install piping and ductwork to best suit field conditions after coordinating with other trades. Run exposed piping and ductwork parallel to, or at right angle to, building walls. Keep horizontal lines as close to bottom of structures as possible. Conform to ceiling heights

established on Drawings.

B. Install equipment in such a manner as to be readily accessible for maintenance and repairs. Install piping, ducts and conduit in such a manner as to preserve headroom, avoid obstructions and keep openings and passageways clear.

C. Installation at valves, thermometers, gauges, cleanouts, dampers, controls, steam and water specialties, duct access doors or any other indicating equipment or specialties requiring reading, adjustment, inspection, maintenance shall be conveniently and accessible located with reference to the finished building.

D. Where wall and ceiling access doors are required but not shown, such doors shall be furnished under other sections and as directed by the Architect. Coordinate this requirement with appropriate trade.

E. If changes in the indicated locations or arrangements are required, they shall be made without additional charges.

F. In an existing area, where required, remove, reinstall, reconnect or replace, etc., any existing work to accommodate new work without any additional cost to the Owner. Material shall match existing, unless otherwise specified or approved in writing by the Architect.

G. Provide sheaves and belts if required, to Test, Adjust and Balance Agency, to allow air moving equipment to meet flow requirements specified at no additional cost to the Owner.

1.18 COORDINATION OF TRADES

A. Contractor shall coordinate all trades in the interest of obtaining the most practical overall arrangement of equipment, piping, conduit, and ducts and to maintain maximum headroom and accessibility.

B. No extras will be allowed for changes made necessary by interference between trades.

C. Submit Composite Drawings in accordance with Special Conditions. Include dimensioned plans, elevations, sections and details and give complete information particularly as to the kinds and types of materials and equipment, size and location of sleeves, inserts, attachments, chases, openings, conduits, ducts, boxes, lighting, structural interferences. Coordinate these Composite Drawings and field layouts in the field for proper relationship to work of applicable trades based on field conditions. Contractor shall have competent personnel readily available for coordinating, checking, and supervision of field layouts. The procedures for submittals and resubmittals, and final distribution shall be as specified in Division 01. Do not start installation of work involved under Composite Drawings until the Architect reviews applicable submittal. Discrepancies between the Drawings and Composite Drawings shall be specifically noted and identified on the Composite Drawings. Drawings for the various trades involved shall be submitted as required and reviewed prior to preparation of Composite Drawings.

1. Equipment Foundations and Bases: Furnish certified details and drawings for approval before fabrication. Furnish parts necessary for each foundation sub base and support.

2. Pipe Sleeves and Inserts: Furnish and install pipe sleeves and pipe support inserts before concrete is poured.

3. Roof, Wall and Floor Openings: Furnish Shop Drawings showing exact locations and sizes of openings through roofs, walls and floors.

4. Concrete: Conform to Concrete Section of the Specifications.

1.19 GUARANTEES

A. Contractor shall guarantee workmanship, equipment and materials installed under his contract for a period of not less than one (1) year from the date of Substantial Completion. Should any defects occur during this period, the Contractor shall promptly repair or replace the defective item and any other damage caused to the building free of charge to the Owner,

including cost of labor and materials.

B. Guarantee included in this section to cover:

1. Faulty or inadequate design of equipment or material installed
2. Improper assembly or erection
3. Defective workmanship or material
4. Incorrect or inadequate operation or other failure

C. He shall guarantee the complete and perfect operation of the entire system and that equipment will be supported in such a way as to be free of objectionable vibration and noise

D. Furnish the parts and labor to replace any items found to be defective in the refrigeration equipment with the guarantee period

E. In addition to other guarantees, furnish free maintenance for the refrigeration equipment, including replacement of refrigerant and oil, for a period of one (1) year. This shall include regular monthly maintenance and "On Call" service if required.

F. For equipment bearing a manufacturer's warranty in excess of one year, furnish a copy of the warranty to the Owner, who shall be named as beneficiary.

1.20 PROTECTION OF EQUIPMENT AND MATERIALS

A. Provide adequate storage facilities for equipment and materials on the site and shall make provisions to protect such materials and equipment from damage.

1.21 CLOSING-IN OF UNINSPECTED WORK

A. Contractor shall not allow or cause any of the work, specifically ductwork and piping, to be covered up or enclosed until it has been inspected, tested, and approved by the Architect. Should any of work be covered up or enclosed before such inspection and test, shall at their own expense, uncover the work and after it has been inspected, tested, and approved, make repairs with such materials as may be necessary to restore work to its original and proper condition.

1.22 BUILDING FOOTING CLEARANCES

A. Under no circumstances shall pipes, ducts, or conduits penetrate footings. They shall cross below footings or through sleeves above footings. Those running parallel to footings shall have the minimum clearance from the cone of influence indicated on the Drawings or as required by Code.

1.23 DAMAGE BY LEAKS

A. Contractor shall be responsible for all damage to any part of the premises caused by rain leaks through or around ducts or pipes, leaks or breaks in piping, equipment or fixtures furnished or installed by him for a period of one (1) year from the date of Substantial Completion.

1.24 EQUIPMENT LABELS

A. Equipment provided under this Section shall be provided with the manufacturer's metal identification labels attached to each individual piece of equipment showing complete performance characteristics, size, model and serial number.

1.25 PRELIMINARY OPERATION

A. Should the Owner request that any portion of the plant, apparatus, or equipment be operated for the Owner's beneficial use prior to the final completion and acceptance of the work, the Contractor shall conform to Beneficial Occupancy Provisions of the General Conditions. Such operation shall be under the supervision and direction of the Contractor. Such preliminary operation shall not be construed as an acceptance of any of the work.

1.26 MAINTAINING EXISTING SERVICES

A. The premises and existing building at the site will be in use at the time the work of this Section is in progress. Contractor shall conduct his work so as to cause no inconvenience or danger to the personnel on the premises.

B. He shall maintain continuity of service to the existing mechanical systems, except for designated intervals during which connections can be made. The scheduling of the shut down period shall be at a time directed by the Architect.

C. In some instances, it may be necessary to defer work in certain areas and locations until such time as existing facilities can be relocated or rearranged by the Owner. Therefore, whenever it becomes necessary for the Contractor to perform work under this contract in areas in which the Owner's work is being performed. This contractor shall advise the Architect relative to this requirement and shall follow closely the directive issued by the Architect insofar as time and procedure are concerned. Allow Owner 72 hours prior notice.

D. This contractor shall include in his bid all premium time to which he may be subjected for performing work in such procedure and at such time as may be necessary to cause the least interference with the function of the Owner.

1.27 ELECTRICAL WORK

A. Coordinate with Division 26 in making the line and low voltage electrical connections and be responsible for the operation of the equipment furnished under this section.

B. Voltage for electrical work will be included in Division 26. However, any control wiring which is required that is not shown on the control diagram shall be as described under this Section. In the event that the Contractor chooses to provide equipment that requires extra expense in the power or control wiring, he shall pay additional electrical costs.

C. Safety switches, starters, circuit breakers, unless provided as a portion of package equipment, and the electrical connections of mechanical equipment to the electrical power service shall be provided under Division 26.

D. Interconnecting wiring, safety switches, relays, controllers and motor starters which are integral components of packaged equipment shall be provided as an integral part of that equipment.

E. All interconnecting power wiring and conduits shall be provided by Division 26.

F. Control wiring shall be provided by Division 22, unless otherwise indicated on the drawings.

G. Conduit for control wiring shall be provided by Division 26.

END OF SECTION

SECTION 22 05 17

SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.01 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

2.02 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Advance Products & Systems, Inc
2. CALPICO, Inc
3. Metraflex Company
4. Pipeline Seal and Insulator, Inc
5. Proco Products, Inc

C. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.03 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.

2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.

2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.

3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.03 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

i. Piping Smaller than NPS 6 (DN 150): Cast-iron wall sleeves.

ii. Piping NPS 6 (DN 150) and Larger: Cast-iron wall sleeves.

2. Exterior Concrete Walls below Grade:
    i. Piping Smaller than NPS 6 (DN 150): Cast-iron wall sleeves with sleeve-seal system.
        1. Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
    ii. Piping NPS 6 (DN 150) and Larger: Cast-iron wall sleeves with sleeve-seal system.
        1. Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
3. Concrete Slabs-on-Grade:
    i. Piping Smaller than NPS 6 (DN 150): Cast-iron wall sleeves with sleeve-seal system.
        1. Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
    i. Piping NPS 6 (DN 150) and Larger: Cast-iron wall sleeves with sleeve-seal system.
        1. Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
4. Concrete Slabs above Grade:
    i. Piping Smaller than NPS 6 (DN 150): Galvanized-steel-pipe sleeves.
    ii. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-pipe sleeves.
5. Interior Partitions:
    i. Piping Smaller than NPS 6 (DN 150): Galvanized-steel-pipe sleeves.
    ii. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION

SECTION 22 05 23

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.
3. Iron, single-flange butterfly valves.
4. Bronze swing check valves.
5. Iron swing check valves.
6. Iron swing check valves with closure control.
7. Bronze gate valves.
8. Iron gate valves.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of valve indicated.

1.03 QUALITY ASSURANCE

A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

B. NSF Compliance: NSF 61 for valve materials for potable-water service.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 8 (DN 200) and larger.
2. Handwheel: For valves other than quarter-turn types.
3. Handlever: For quarter-turn valves NPS 6 (DN 150) and smaller except plug valves.

E. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:

1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Solder Joint: With sockets according to ASME B16.18.
3. Threaded: With threads according to ASME B1.20.1.

2.02 BRASS BALL VALVES

A. One-Piece, Reduced-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    i. Kitz Corporation.
    ii. Nibco
2. Description:
    i. Standard: MSS SP-110.
    ii. CWP Rating: 400 psig (2760 kPa).
    iii. Body Design: One piece.
    iv. Body Material: Forged brass.
    v. Ends: Threaded.
    vi. Seats: PTFE or TFE.
    vii. Stem: Brass.
    viii. Ball: Chrome-plated brass.
    ix. Port: Reduced.

B. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    i. Crane Co.; Crane Valve Group; Crane Valves.
    ii. Flow-Tek, Inc.; a subsidiary of Bray International, Inc.
    iii. Hammond Valve.
    iv. Milwaukee Valve Company.
    v. NIBCO INC.
2. Description:
    i. Standard: MSS SP-110.
    ii. SWP Rating: 150 psig (1035 kPa).
    iii. CWP Rating: 600 psig (4140 kPa).
    iv. Body Design: Two piece.
    v. Body Material: Forged brass.
    vi. Ends: Threaded.
    vii. Seats: PTFE or TFE.
    viii. Stem: Brass.
    ix. Ball: Chrome-plated brass.
    x. Port: Full.

C. Two-Piece, Regular-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    i. Hammond Valve.
    ii. Milwaukee Valve Company.
2. Description:
    i. Standard: MSS SP-110.
    ii. SWP Rating: 150 psig (1035 kPa).
    iii. CWP Rating: 600 psig (4140 kPa).
    iv. Body Design: Two piece.
    v. Body Material: Forged brass.
    vi. Ends: Threaded.
    vii. Seats: PTFE or TFE.
    viii. Stem: Brass.
    ix. Ball: Chrome-plated brass.
    x. Port: Regular.

2.03 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    i. American Valve, Inc.
    ii. Conbraco Industries, Inc.; Apollo Valves.
    iii. Crane Co.; Crane Valve Group; Crane Valves.
    iv. Hammond Valve.
    v. Milwaukee Valve Company.
    vi. NIBCO INC.
2. Description:
    i. Standard: MSS SP-110.
    ii. SWP Rating: 150 psig (1035 kPa).
    iii. CWP Rating: 600 psig (4140 kPa).
    iv. Body Design: Two piece.
    v. Body Material: Bronze.
    vi. Ends: Threaded.
    vii. Seats: PTFE or TFE.
    viii. Stem: Bronze.
    ix. Ball: Chrome-plated brass.
    x. Port: Full.

2.04 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    i. Conbraco Industries, Inc.; Apollo Valves.
    ii. Crane Co.; Crane Valve Group; Jenkins Valves.
    iii. Crane Co.; Crane Valve Group; Stockham Division.
    iv. Hammond Valve.
    v. Milwaukee Valve Company.
    vi. NIBCO INC.
2. Description:
    i. Standard: MSS SP-67, Type I.
    ii. CWP Rating: 200 psig (1380 kPa).
    iii. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
    iv. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
    v. Seat: EPDM.
    vi. Stem: One- or two-piece stainless steel.
    vii. Disc: Aluminum bronze.

B. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Aluminum-Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    i. Conbraco Industries, Inc.; Apollo Valves.
    ii. Crane Co.; Crane Valve Group; Jenkins Valves.
    iii. Crane Co.; Crane Valve Group; Stockham Division.
    iv. Hammond Valve.
    v. Milwaukee Valve Company.
    vi. NIBCO INC.
2. Description:
    i. Standard: MSS SP-67, Type I.
    ii. CWP Rating: 200 psig (1380 kPa).
    iii. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
    iv. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
    v. Seat: NBR.
    vi. Stem: One- or two-piece stainless steel.
    vii. Disc: Aluminum bronze.

2.05 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    i. American Valve, Inc.
    ii. Crane Co.; Crane Valve Group; Crane Valves.
    iii. Crane Co.; Crane Valve Group; Jenkins Valves.
    iv. Hammond Valve.
    v. Milwaukee Valve Company.
    vi. NIBCO INC.
2. Description:
    i. Standard: MSS SP-80, Type 3.
    ii. CWP Rating: 200 psig (1380 kPa).
    iii. Body Design: Horizontal flow.
    iv. Body Material: ASTM B 62, bronze.
    v. Ends: Threaded.

2.06 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Nonmetallic-to-Metal Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    i. Crane Co.; Crane Valve Group; Crane Valves.
    ii. Crane Co.; Crane Valve Group; Stockham Division.
2. Description:
    i. Standard: MSS SP-71, Type I.
    ii. CWP Rating: 200 psig (1380 kPa).
    iii. Body Design: Clear or full waterway.
    iv. Body Material: ASTM A 126, gray iron with bolted bonnet.
    v. Ends: Flanged.
    vi. Trim: Composition.
    vii. Seat Ring: Bronze.
    viii. Disc Holder: Bronze.
    ix. Disc: PTFE or TFE.
    x. Gasket: Asbestos free.

2.07 BRONZE GATE VALVES

A. Class 125, NRS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    i. American Valve, Inc.
    ii. Crane Co.; Crane Valve Group; Crane Valves.
    iii. Crane Co.; Crane Valve Group; Jenkins Valves.

iv. Crane Co.; Crane Valve Group; Stockham Division.

v. Hammond Valve.

vi. Milwaukee Valve Company.

vii. NIBCO INC.

2. Description:

i. Standard: MSS SP-80, Type 1.

ii. CWP Rating: 200 psig (1380 kPa).

iii. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.

iv. Ends: Threaded or solder joint.

v. Stem: Bronze.

vi. Disc: Solid wedge; bronze.

vii. Packing: Asbestos free.

viii. Handwheel: Malleable iron, bronze, or aluminum.

B. Class 125, RS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

i. American Valve, Inc.

ii. Crane Co.; Crane Valve Group; Crane Valves.

iii. Crane Co.; Crane Valve Group; Jenkins Valves.

iv. Hammond Valve.

v. Milwaukee Valve Company.

vi. NIBCO INC<http://www.specagent.com/LookUp/?uid=123456805097&mf=04&src=wd>.

2. Description:

i. Standard: MSS SP-80, Type 2.

ii. CWP Rating: 200 psig (1380 kPa).

iii. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.

iv. Ends: Threaded or solder joint.

v. Stem: Bronze.

vi. Disc: Solid wedge; bronze.

vii. Packing: Asbestos free.

viii. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.01 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Shut-off valves shall be provided in main branches, runs to risers and where indicated on drawings

C. Locate valves for easy access and provide separate support where necessary.

D. Install valves in horizontal piping with stem at or above center of pipe.

E. Install valves in position to allow full stem movement.

F. Install on operators for butterfly valves NPS 4 (DN 100) and larger and more than 96 inches (2400 mm) above floor. Extend chains to 60 inches (1520 mm above finished floor.

1. Install swing check valves for proper direction of flow and in horizontal position with hinge pin level.

3.02 ADJUSTING

A. 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.

3.03 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball or butterfly valves.
2. Throttling Service: ball, or butterfly valves.
3. Pump-Discharge Check Valves:
   i. NPS 2 (DN 50) and Smaller: Bronze swing check valves with bronze disc.
   ii. NPS 2-1/2 (DN 65) and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring.
   iii. NPS 2-1/2 (DN 65) and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.
4. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged ends.

3.04 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Angle Valves: Class 125, bronze disc.
3. Ball Valves: Two piece, full port, brass or bronze with brass trim.
4. Bronze Swing Check Valves: Class 125, bronze or nonmetallic disc.

5. Bronze Gate Valves: Class 125, NRS.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to NPS 100): May be provided with threaded ends instead of flanged ends.
2. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM seat, aluminum-bronze disc.
3. Iron Swing Check Valves: Class 125, nonmetallic-to-metal seats.
4. Iron Swing Check Valves with Closure Control: Class 125, lever and spring.
5. Iron Gate Valves: Class 125 OS&Y.
6. Iron Globe Valves: Class 125.

3.05 SANITARY-WASTE AND STORM-DRAINAGE VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Two piece, full port, brass or bronze with brass trim.
3. Bronze Swing Check Valves: Class 125, bronze disc.
4. Bronze Gate Valves: Class 125, NRS.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to NPS 100): May be provided with threaded ends instead of flanged ends.
2. Iron Swing Check Valves: Class 125, nonmetallic-to-metal seats.
3. Iron Swing Check Valves with Closure Control: Class 125, lever and spring.
4. Iron Gate Valves: Class 125, OS&Y.

END OF SECTION

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Pipe positioning systems.
6. Equipment supports.

1.02 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7

1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.04 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.05 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.01 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.02 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.03 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa), ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.04 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated- steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.05 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.06 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural

carbon-steel shapes.

2.07 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.01 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:

1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:

1. Attach clamps and spacers to piping.
    i. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    ii. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    iii. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    i. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    i. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
    i. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
    ii. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
    iii. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
    iv. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
    v. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.02 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.03 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the

following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.04 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.05 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099113 "Exterior Painting." And Section 099123 "Interior Painting."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.06 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.

3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Welded-Steel Brackets: For support of pipes from below, or for suspending from

above by using clip and rod. Use one of the following for indicated loads:

i. Light (MSS Type 31): 750 lb (340 kg).

ii. Medium (MSS Type 32): 1500 lb (680 kg).

iii. Heavy (MSS Type 33): 3000 lb (1360 kg).

8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.

2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.

3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).

2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.

3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

Q. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION

SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.02 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.

D. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2013.

E. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2016.

F. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2015.

G. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2016a.

H. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2013).

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

J. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

K. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

PART 2 - PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER

A. Manufacturers:

1. CertainTeed Corporation: www.certainteed.com.
2. Johns Manville Corporation: www.jm.com.
3. Knauf Insulation: www.knaufusa.com.
4. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ: www.ocbuildingspec.com/sle.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.

1. 'K' Value: ASTM C177, 0.24 at 75 degrees F.
2. Maximum Service Temperature: 850 degrees F.
3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:

1. Armacell LLC: www.armacell.us.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.

1. Minimum Service Temperature: Minus 40 degrees F.
2. Maximum Service Temperature: 220 degrees F.
3. Connection: Waterproof vapor barrier adhesive.

2.04 JACKETS

A. PVC Plastic.

1. Manufacturers:
    i. Johns Manville Corporation: www.jm.com.
2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
    i. Minimum Service Temperature: 0 degrees F.
    ii. Maximum Service Temperature: 150 degrees F.
    iii. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
    iv. Thickness: 10 mil.
    v. Connections: Brush on welding adhesive.

B. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.

1. Thickness: 0.016 inch sheet.
2. Finish: Smooth.
3. Joining: Longitudinal slip joints and 2 inch laps.
4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance witqh North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Install insulation on piping accessories requiring future re-occurring access and service with factory fabricated insulation covers that are easily removed and reapplied

F. Glass fiber insulated pipes conveying fluids below ambient temperature:

1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.

2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

G. Glass fiber insulated pipes conveying fluids above ambient temperature:

1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.

2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

H. Inserts and Shields:

1. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.

2. Insert Location: Between support shield and piping and under the finish jacket.

3. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.

I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 84 00.

J. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

K. Buried Piping: Provide factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

END OF SECTION

SECTION 22 10 05

PLUMBING PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, specialties, and connections for piping systems.

1. Sanitary sewer and vent.
2. Chemical resistant sewer.
3. Domestic water.
4. Natural Gas.
5. Flanges, unions, and couplings.
6. Pipe hangers and supports.
7. Valves.

1.02 REFERENCE STANDARDS

A. ANSI Z21.22 - American National Standard for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems; 1999, and addenda A&B (R2004).

B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2016.

C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.

D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.

E. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV; 2011.

F. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV; 2012.

G. ASME B31.1 - Power Piping; 2016.

H. ASME B31.9 - Building Services Piping; 2014.

I. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; 2015.

J. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

K. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2017.

L. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

M. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2015a.

N. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2016.

O. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2016.

P. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2016.

Q. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2016.

R. ASTM C425 - Standard Specification for Compression Joints for Vitrified Clay Pipe and

Fittings; 2004 (Reapproved 2013).

S. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2014.

T. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2015.

U. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings; 2004 (Reapproved 2011).

V. ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter; 2012a.

W. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series); 2015.

X. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2012.

Y. ASTM D2661 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings; 2014.

Z. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2014.

AA. ASTM D2846/D2846M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems; 2014.

AB. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings; 2014.

AC. ASTM F628 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core; 2012e2.

AD. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992 (Reapproved 2008).

AE. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011-AMD 1.

AF. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; 2009 (Revised 2012).

AG. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2011 (Revised 2012).

AH. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

AI. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.

AJ. NSF 61 - Drinking Water System Components - Health Effects; 2016.

AK. NSF 372 - Drinking Water System Components - Lead Content; 2016.

AL. ASME - Boiler and Pressure Vessel Code

AM. AGA - American Gas Association Code

1.03 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

B. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with State of California, standards.

1. Maintain one copy on project site.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Conform to ASME BPVC-IX and applicable state labor regulations.

D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

E. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.05 REGULATORY REQUIREMENTS

A. Perform Work in accordance with State of California plumbing code.

B. Conform to applicable code for installation of backflow prevention devices.

C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: CISPI 301, hubless with polyethylene wrap.

1. Fittings: Cast iron.

2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

B. ABS Pipe: ASTM F628.

1. Fittings: ABS.

2. Joints: Solvent welded with ASTM D2235 cement.

2.03 CHEMICAL RESISTANT SEWER PIPING

A. CPVC Pipe: ASTM F 2618

1. Fittings: CPVC

2. Joints: Solvent Cement welded per ASTM F 493

3. Surface burning characteristics of building materials per ASTM E 84-13a

2.04 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Copper Pipe: Class 150 bronze unions with brazed joints below grade, hard drawn.

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.

2.05 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), Drawn (H).

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.

2. Joints: ASTM B32, alloy Sn95 solder.

B. PVC Pipe: ASTM D1785 or ASTM D2241.

1. Fittings: ASTM D2665, PVC.

2. Joints: ASTM D2846/D2846M, solvent weld with ASTM F493 solvent cement.

2.06 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.

1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.

2. Joints: Threaded or welded to ASME B31.1.

3. All exposed piping shall be painted or jacketed.

2.07 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:

1. Ferrous pipe: Class 150 malleable iron threaded unions.

2. Copper tube and pipe: Class 150 bronze unions with soldered joints.

2.08 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.

1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.

3. Trapeze Hangers: Welded steel channel frames attached to structure.

4. Vertical Pipe Support: Steel riser clamp.

B. Plumbing Piping - Drain, Waste, and Vent:

1. Conform to ASME B31.9.

2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.

3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.

C. Plumbing Piping - Water:

1. Conform to ASME B31.9.

2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 Inches to 4 Inches: Carbon steel, adjustable, clevis.

2.09 BALL VALVES

A. Manufacturers:
1. Tyco Flow Control: www.tycoflowcontrol.com.
2. Apollo Valves: www.apollovalves.com.
3. Stockham: www.stockham.com

B. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze, two piece body, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder ends with union.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
B. Remove scale and dirt, on inside and outside, before assembly.
C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
E. Group piping whenever practical at common elevations.
F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 22 05 16.
G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
H. Shut-off valves shall be provided on all main branches, runs to risers and where shown on drawings. Locate shut-off valves over T-Bar Ceiling when possible. Provide access panesl when shut-off valves are located over hard lid ceilings.
I. Provide access where valves and fittings are not exposed.
J. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Color to be specified by architect.
K. All exposed, unfinished pipe, fittings, supports, and accessories shall be painted.
L. All piping, fittings, supports and accessories shall approved UV protection
M. Install valves with stems upright or horizontal, not inverted. Refer to Section 22 05 23.

N. Provide stem extension on all valves for piping requiring insulation to ensure valve can be cycled without damaging pipe insulation.

O. Install water piping to ASME B31.9.

P. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

Q. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9.
2. Support horizontal piping as indicated.
3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

3.04 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install globe valves for throttling, bypass, or manual flow control services.

C. Provide spring loaded check valves on discharge of water pumps.

3.05 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect water distribution system in accordance with Section 33 01 10.58.

B. Prior to starting work, verify system is complete, flushed and clean.

3.06 SERVICE CONNECTIONS

A. Provide new sanitary sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

END OF SECTION

SECTION 22 10 06

PLUMBING PIPING SPECIALTIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Drains.

B. Water hammer arrestors.

1.02 REFERENCE STANDARDS

A. ASME A112.6.3 - Floor and Trench Drains; 2001 (R2007).

B. ASSE 1011 - Hose Connection Vacuum Breakers; 2004.

C. ASSE 1012 - Backflow Preventer with Intermediate Atmospheric Vent; 2009.

D. ASSE 1013 - Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers; 2011.

E. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance; 2011.

F. NSF 61 - Drinking Water System Components - Health Effects; 2016.

G. NSF 372 - Drinking Water System Components - Lead Content; 2016.

H. PDI-WH 201 - Water Hammer Arresters; 2010.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

C. Certificates: Certify that grease interceptors meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 DRAINS

A. Manufacturers:

1. Josam Company: www.josam.com.
2. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
3. Zurn Industries, LLC: www.zurn.com.

B. Floor Drain:

1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.

2.03 CLEANOUTS

A. Manufacturers:

1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
2. Josam Company: www.josam.com.
3. Zurn Industries, LLC: www.zurn.com.

B. Cleanouts at Interior Finished Floor Areas:

1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.

C. Cleanouts at Interior Finished Wall Areas:

1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

2.04 WATER HAMMER ARRESTORS

A. Manufacturers:

1. Precision Plumbing Products: www.pppinc.com.
2. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com.
3. Zurn Industries, LLC: www.zurn.com.
4. Mifab: www.mifab.com

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C. Install floor cleanouts at elevation to accommodate finished floor.

D. Install approved portable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.

E. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatory sinks.

END OF SECTION

SECTION 22 40 00

PLUMBING FIXTURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Water closets.

B. Lavatories.

C. Eye and face wash fountains.

D. Emergency showers.

1.02 REFERENCE STANDARDS

A. ANSI Z124.2 - American National Standard for Plastic Shower Units; 1995.

B. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment; 2014.

C. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2002).

D. ASME A112.18.1 - Plumbing Supply Fittings; 2012.

E. ASME A112.19.1M - Enameled Cast Iron Plumbing Fixtures; The American Society of Mechanical Engineers; 2008 (R2011).

F. ASME A112.19.2 - Ceramic Plumbing Fixtures; 2013.

G. ASME A112.19.3 - Stainless Steel Plumbing Fixtures; 2008 (R2013).

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

I. NSF 61 - Drinking Water System Components - Health Effects; 2016.

J. NSF 372 - Drinking Water System Components - Lead Content; 2016.

1.03 SUBMITTALS

A. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

B. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.05 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

PART 2 - PRODUCTS

2.01 GENERAL

A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 FLUSH VALVE WATER CLOSETS

A. Water Closets: Vitreous china, ASME A112.19.2, floor mounted, siphon jet flush action, china bolt caps.

1. Flush Volume: 1.28 gallon, maximum.
2. Flush Valve: Exposed (top spud).
3. Flush Operation: Sensor operated.
4. Handle Height: 44 inches or less.
5. Manufacturers:

i. American Standard Inc: www.americanstandard.com.

b. Sloan Valve Company: www.sloanvalve.com.

c. Kohler Company; _____: www.kohler.com.

d. Substitutions: See Section 01 60 00 - Product Requirements.

B. Flush Valves: ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories.

1. Sensor-Operated Type: Solenoid operator, battery powered, infrared sensor and over-ride push button.
2. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop.
3. Manufacturers:

i. American Standard, Inc: www.americanstandard-us.com/#sle.

ii. Sloan Valve Company: www.sloanvalve.com.

iii. Zurn Industries, Inc: www.zurn.com.

C. Seats:

1. Manufacturers:

i. American Standard, Inc: www.americanstandard-us.com/#sle.

ii. Bemis Manufacturing Company: www.bemismfg.com.

iii. Substitutions: See Section 01 60 00 - Product Requirements.

2. Solid white plastic, open front, extended back, self-sustaining hinge, brass bolts, with cover.

D. Water Closet Carriers:

1. Manufacturers:

i. JOSAM Company: www.josam.com.

ii. Jay R. Smith MFG Co: www.jrsmith.com

iii. Substitutions: See Section 01 60 00 - Product Requirements.

2. ASME A112.6.1M; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

2.03 LAVATORIES

A. Lavatory Manufacturers:

1. American Standard Inc: www.americanstandard.com.
2. Kohler Company: www.kohler.com.

B. Vitreous China Wall Hung Basin: ASME A112.19.2; vitreous china wall hung lavatory, _____ minimum, with 4 inch high back, rectangular basin with splash lip, front overflow, and soap depression.

C. Supply Faucet Manufacturers:

1. Chicago Faucets, a Geberit company: www.chicagofaucets.com.
2. Kohler Company: www.kohler.com.

D. Supply Faucet:

E. Sensor Operated Faucet: Cast brass, chrome plated, deck mounted with sensor located on neck of spout.

1. Spout Style: Swivel gooseneck.
2. Power Supply: Battery, easily replaceable, alkaline or lithium, minimum 200,000 cycles.
3. Mixing Valve: Internal, automatic.
4. Water Supply: 3/8 inch compression connections.
5. Aerator: Vandal resistant, 0.5 GPM, laminar flow device.
6. Finish: Polished chrome.

2.04 SERVICE SINKS

A. Service Sink Manufacturers:

1. American Standard, Inc; _____: www.americanstandard-us.com/#sle.
2. Elkay Manufacturing Company; _____: www.elkay.com.
3. Just Manufacturing Company; _____: www.justmfg.com.
4. Fiat Products. www.fiatproduct.com

B. Bowl: 24 by 24 by 10 inch high _____ molded stone, floor mounted, with one inch wide shoulders, aluminum bumper guard, stainless steel strainer.

C. Trim: ASME A112.18.1 exposed wall type supply with cross handles, spout wall brace, vacuum breaker, hose end spout, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges.

D. Accessories:

1. Hose clamp hanger.
2. Mop hanger.

2.05 EMERGENCY EYE AND FACE WASH

A. Emergency Wash: ANSI Z358.1; wall-mounted, self-cleaning, non-clogging eye and face wash with quick opening, full-flow valves, stainless steel eye and face wash receptor, twin eye wash heads and face spray ring, stainless steel dust cover, copper alloy control valve and fittings.

2.06 EMERGENCY SHOWERS

A. Emergency Shower: ANSI Z358.1; wall-mounted, self- cleaning, non-clogging 8 inch diameter stainless steel deluge shower head with elbow, one inch full flow valve with pull

chain and 8 inch diameter ring, one inch interconnecting fittings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.03 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome plated rigid or flexible supplies to fixtures with loose key or integral stops, reducers, and escutcheons.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall supports and bolts.

3.04 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.05 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.06 CLEANING

A. Clean plumbing fixtures and equipment.

3.07 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Do not permit use of fixtures by construction personnel.

C. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 23 00 10

BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Basic Mechanical Requirements specifically applicable to Division 23 Sections, in addition to Division 01 - General Requirements.

1.02 DESCRIPTION

A. Furnish materials and perform labor required to execute this work as indicated on the drawings, as specified and as required to complete the work of this section, except as otherwise herein specifically excluded.

1.03 REFERENCES

A. Section 23 08 01 - Commissioning of Building Systems

1.04 WORK INCLUDED

A. The complete Heating, Ventilating and Air Conditioning (HVAC) systems, including but not limited to these major items.

1. Coordinate work of this Section with related trades.
2. Verify applicable dimensions at the jobsite.
3. Duct systems; supply, return and exhaust complete with fire dampers, combination fire-smoke dampers, and manual dampers.
4. Diffusers and registers.
5. Exhaust, supply and return fans.
6. Furnishing and installation of miscellaneous hangers, supports, sleeves, inserts, anchors and other auxiliary equipment for systems under this Division.
7. Duct lining and insulation.
8. Shop drawings.
9. Equipment identification.
10. Equipment and systems adjustments and balancing.
11. Air, water and gas systems testing, adjusting and balancing.
12. Written operating and maintenance instructions.
13. Record drawings.
14. Guarantee

1.05 WORK SPECIFIED ELSEWHERE

A. Concrete, Architectural Sheet Metal, Door and Exterior Wall Louvers, Painting and Electrical.

1.06 SITE INSPECTION

A. Contractor shall familiarize himself with the conditions at the site. No allowance will be made subsequently for any error through negligence in observing the site conditions. Contractor shall observe and make cost allowance for any mechanical and/or electrical items that must be relocated to accommodate the installation or servicing of any item covered under this contract.

1.07 ORDINANCES, REGULATIONS AND CODES

A. References to Technical Societies, Trade Organizations, Governmental Agencies is made in Division 15 in accordance with the following abbreviations.

1. AFI - Air Filter Institute
2. AMCA - Air Moving & Conditioning Association
3. ARI - Air Conditioning & Refrigeration Institute
4. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers
5. ASME - American Society of Mechanical Engineers
6. ASTM - American Society of Testing Materials
7. AWSC - American Welding Society Code
8. ANSI - American National Standards Institute
9. CBC - California Building Code
10. CCR - California Code of Regulations
11. CEC - California Electrical Code
12. CFC - California Fire Codes
13. CMC - California Mechanical Code
14. CPC - California Plumbing Code
15. FIA - Factory Insurance Association
16. NAFM - National Association of Fan Manufacturers
17. NEMA - National Electrical Manufacturer's Association
18. NFPA - National Fire Protection Association
19. ORS - Office of Regulatory Services
20. SCAQMD - South Coast Air Quality Management District
21. SMACNA - Sheet Metal and Air Conditioning Contractors National Association
22. UFC - Uniform Fire Code
23. UL - Underwriter's Laboratories
24. UPC - Uniform Plumbing Code

B. Requirements of Regulatory Agencies: Materials and installation shall comply with applicable local, state, and national codes and ordinances. Rulings and interpretations of the enforcing agencies shall be considered as part of the local codes. No extras will be permitted for furnishing items required by the local codes but not specified or shown on the drawings.

C. Codes and Standards:

1. UBC and California Amendments (California Building Code - Part 2, Title 24, CCR).
2. UMC and California Amendments (California Mechanical Code - Part 4, Title 24 CCR).
3. UPC and California Amendments (California Plumbing Code - Part 5, Title 24 CCR).
4. Uniform Fire Code with State Amendments (California Fire Code - Part 9, Title 24 CCR).

5. National Fire Protection Associations - National Fire Code.

D. Nothing in these drawings and specifications is to be construed to permit work in violation thereof. Ordinances, regulations and codes are to be construed as minimum requirements.

E. The responsibility of the Architect to conduct construction reviews of the Contractor's performance is not intended to include the adequacy of the Contractor's safety measures in, on, or near the construction site.

F. Ventilating, refrigeration and electrical equipment and appliances are required to be approved by the Underwriters' Laboratories, Inc., or other nationally recognized testing agency and installed per the testing agency's specifications.

1.08 PERMITS, FEES AND INSPECTIONS

A. Obtain and pay for all necessary permits, fees, assessments, complimentary drawings, required by any legally constituted public authorities having jurisdiction.

1.09 DRAWINGS AND SPECIFICATIONS

A. The Architect's decision will be final on interpretation of the Drawings and Specifications.

B. The Drawings and Specifications are complimentary. Any work called for on the Drawings and not mentioned in the Specifications, or vice versa, shall be performed as though fully set forth in both.

C. Piping, ductwork and other equipment shown as existing has been taken from the Owner's drawings. Contractor shall verify exact location in field before proceeding with the work.

D. Where codes, standards, drawings or specifications conflict, the most stringent shall prevail, unless prior approval for variance is obtained. Specific details on the drawings shall supercede the specification in the event of a conflict.

E. Alternate support or seismic detail shall have prior approval by the Architect; and the Contractor shall obtain agency approval without any additional cost or time to the contract and without any time penalty on the work schedule.

1.10 SUBMITTALS

A. Before starting work, the Contractor shall furnish for the approval of the Architect, Shop Drawings and Submitalls with Itemized Equipment Lists, complete in all details that they proposes to install. All items shall be submitted at the same time.

B. Submittals must be specific to this project with respect to model number, capacities, performance, etc., generic submittals will not be accepted.

C. Variations or deviations on submitted items from that specified must be clearly tagged and / or identified

D. Submittals shall include, but not necessarily be limited to the following which are mandatory:

1. Draw Equipment Layouts to ¼” scale, including equipment, piping accessories, and showing clearances for operating and servicing.
2. Schedule of pipe, fittings, valves, with manufacturer and catalog number.
3. Specialties, valves, gauges and thermometers of all types.
4. Foundations, supports, hangers, inserts.
5. Earthquake supports and calculations.
6. Insulation.
7. Ventilation and air conditioning equipment, specialties and the air control systems.
8. Fans, fan characteristic curves, fan tests.

9. Dampers, louvers, grilles, registers, diffusers.
10. Shop fabrication drawings and installation drawings of ductwork and piping layouts. Submit for approval prior to fabrication. Drawings shall indicate dimensions from bottom of piping and ductwork to finish floor level.
11. Wiring diagrams, control panel board, motor starters and controls for electrically operated equipment furnished by mechanical trades.
12. Automatic control system diagrams.
13. Exhaust, supply and return fans.
14. Access panels.
15. Hangers, inserts, supports, anchors.
16. Sleeves, escutcheons, caulking, waterproofing, fireproofing.
17. Shop fabrications drawings and calculations.
18. Special and miscellaneous products furnished under this section and not listed herein.

1.11 RECORD DRAWINGS AND MANUALS

A. Record Set During the Work: At site, maintain at least one set of Drawings as a Field Record Set. Also maintain at least one copy of all Addenda, Modifications, approved submittals, correspondence, and transmittals at site. Keep Drawings and data in good order and readily available to Architect and Owner.

B. Changes: Clearly and correctly mark Record Drawings to show changes made during the construction process at the time the changed work is installed. No such changes shall be made in the work unless authorized by the Architect.

C. Final Record Drawings: Conform to Division 01 requirements.

D. Preparation of Final Record Drawings: Contractor shall transfer recorded changes in the work indicated on the Field Record Set to the record set. Changes shall be neatly and clearly drawn and noted by skilled draftsmen, and shown technically correct.

E. Approval: Prior to Architect's inspection for Substantial Completion, submit the Final Record Drawings to the Architect for review, and make such revisions as may be necessary for Final Record Drawings to be a true, complete, and accurate record of the work.

F. Manuals: Obtain data from the various manufacturers and submit instruction, operation, and maintenance manuals as required and to the extent required under other Sections.

G. Contents: Each manual shall have an index listing the contents. Information in the manuals shall include not less than:

1. General introductions and overall equipment description, purpose, functions and simplified theory of operation.
2. Specifications
3. Installation instructions, procedures, sequences, and precautions, including tolerances for level, horizontal and vertical alignment.
4. Grouting requirements.
5. List showing lubricants for each item of mechanical equipment and recommended lubrication intervals.
6. Start-up and beginning operation procedures.
7. Operational procedures.

8. Shutdown procedures.
9. Maintenance and calibration procedures
10. Parts lists
11. Name, address and telephone number of each manufacturer's local representative.

H. Manual Submittals: Unless otherwise specified, each submittal shall include two copies of each manual, one of which will be returned to the Contractor, marked to show the required review. When approved, deliver four copies to Architect unless otherwise specified.

I. "As-Built" drawings of ductwork and piping, including all elbows, transitions, damper and valve locations shall be provided prior to commencement of air and water balance.

1.12 QUALITY OF EQUIPMENT, MATERIALS AND WORKMANSHIP

A. Unless otherwise specified, equipment and materials used in the installation shall be new and in perfect condition when installed. Articles provided for the same general purpose or use shall be of the same make. Workmanship shall be of the best quality and none but competent mechanics skilled in their trades shall be employed. Furnish the services of an experienced superintendent, who shall be constantly in charge of the work, together with all necessary journeymen, helpers and laborers required.

1.13 SEISMIC DESIGN

A. Contractor shall be responsible for anchors and connections of mechanical work to the building structure including calculations for approval by structural engineer or for approval by inspector of record, as applies, for items or work, where approval is deferred or where alternate support or anchorage detail is proposed to prevent damage as a result of an earthquake, including manufactured equipment, the connection and integrity of shop fabricated and field fabricated materials and equipment. The anchorage of all pipes, ducts, conduits, fixtures, equipment, etc. shall withstand the lateral forces and shall accommodate calculated building displacement as required by the California Building Code, and local city/county codes. (Building equipment and connections therefore shall be designed to resist lateral seismic forces equal to 1.0 of equipment weight to working allowable stress. Cantilever posts supporting equipment shall be designed to resist lateral seismic forces equal to 0.5 of equipment weight to allowable working stress. Conform to the following:

1. In accordance with Title 24, 2010 CBC Chapter 16, details shall be provided for the seismic anchorage of all mechanical and electrical equipment, anchorage details shall be based upon appropriate design calculations.
2. For equipment weighing 400 pounds or more anchorage details and appropriate design calculations shall be submitted as part of the mechanical and electrical drawings. "Deferred Approval" items will not be permitted unless specifically approved by the plan check supervisor.
    i. Exception: Attachments of equipment weighting less than 400 pounds and supported directly on the floor or roof structure, furniture, or temporary or movable equipment and equipment weighing less than 20 pounds that is supported by vibration isolation devices suspended from the roof, wall or floor, need not be detailed on the plans provided the following notes are included on the mechanical and electrical plans.
3. The seismic anchorage of mechanical and electrical equipment shall conform to C.C.R. Title 24, 2010 CBC Chapter 16. Anchorage details for roof/floor-mounted equipment shall be shown on plans.

1.14 SUBSTITUTIONS AND CHANGES

A. The design has been based on data from certain manufacturers, suitable for each application. Recommendations for alternative manufacturers are made for each product,

except when "no substitutions permitted" is indicated.

B. It is the intent of the Owner to have this project constructed with materials, products and system originally designed and specified into the project.

C. Alternatives that may require the modification, realignment and/or adjustment of other associated components, including impact on other trades, shall be accomplished at no additional cost or time to the contract and shall have the approval of the Architect.

D. Substitutions shall be submitted addressing all features listed in the specifications. Features that deviate from the plans and specifications shall be clearly identified including justification for deviations. Design West Engineers will review initial submittal on substitutes only. Subsequent submittals made to correct deficiencies in original submittals will be reviewed at Contractor's expense based on Design West Engineer's hourly rate for engineering services.

E. Should the Contractor elect to propose substitutions for the Owner's interest, the substitutions shall be in compliance with Division 01.

1.15 APPROVALS

A. The Architect will have the right to accept or reject equipment, materials, workmanship, tests and determine when the Contractor has complied with the requirements herein specified.

1.16 SELECTION AND ORDERING OF EQUIPMENT AND MATERIALS

A. Immediately after award of the Contract and after the approval of submittals by the Architect, the Contractor shall arrange for the purchase and delivery of equipment and materials required, in ample quantities and at the proper time. He shall deliver to the Architect a complete list of equipment and materials ordered, giving descriptions, plate numbers, brochures, name of the wholesalers, date of the orders and approximate delivery dates.

1.17 LOCATIONS AND ACCESSIBILITY

A. Drawings show pipe and ductwork diagrammatically. Conform to Drawings as closely as possible in layout work. Vary run of piping, run and shape of ductwork and make offsets during progress of work as required to meet structural and other interferences as approved by Architect. Install piping and ductwork to best suit field conditions after coordinating with other trades. Run exposed piping and ductwork parallel to, or at right angle to, building walls. Keep horizontal lines as close to bottom of structures as possible. Conform to ceiling heights established on Drawings.

B. Install equipment in such a manner as to be readily accessible for maintenance and repairs. Install piping, ducts and conduit in such a manner as to preserve headroom, avoid obstructions and keep openings and passageways clear.

C. Installation at valves, thermometers, gauges, cleanouts, dampers, controls, steam and water specialties, duct access doors or any other indicating equipment or specialties requiring reading, adjustment, inspection, maintenance shall be conveniently and accessible located with reference to the finished building.

D. Where wall and ceiling access doors are required but not shown, such doors shall be furnished under other sections and as directed by the Architect. Coordinate this requirement with appropriate trade.

E. If changes in the indicated locations or arrangements are required, they shall be made without additional charges.

F. In an existing area, where required, remove, reinstall, reconnect or replace, etc., any existing work to accommodate new work without any additional cost to the Owner. Material shall match existing, unless otherwise specified or approved in writing by the Architect.

G. Provide sheaves and belts if required, to Test, Adjust and Balance Agency, to allow air moving equipment to meet flow requirements specified at no additional cost to the Owner.

1.18 COORDINATION OF TRADES

A. Contractor shall coordinate all trades in the interest of obtaining the most practical overall arrangement of equipment, piping, conduit, and ducts and to maintain maximum headroom and accessibility.

B. No extras will be allowed for changes made necessary by interference between trades.

C. Submit Composite Drawings in accordance with Special Conditions. Include dimensioned plans, elevations, sections and details and give complete information particularly as to the kinds and types of materials and equipment, size and location of sleeves, inserts, attachments, chases, openings, conduits, ducts, boxes, lighting, structural interferences. Coordinate these Composite Drawings and field layouts in the field for proper relationship to work of applicable trades based on field conditions. Contractor shall have competent personnel readily available for coordinating, checking, and supervision of field layouts. The procedures for submittals and resubmittals, and final distribution shall be as specified in Division 01. Do not start installation of work involved under Composite Drawings until the Architect reviews applicable submittal. Discrepancies between the Drawings and Composite Drawings shall be specifically noted and identified on the Composite Drawings. Drawings for the various trades involved shall be submitted as required and reviewed prior to preparation of Composite Drawings.

1. Equipment Foundations and Bases: Furnish certified details and drawings for approval before fabrication. Furnish parts necessary for each foundation sub base and support.
2. Pipe Sleeves and Inserts: Furnish and install pipe sleeves and pipe support inserts before concrete is poured.
3. Roof, Wall and Floor Openings: Furnish Shop Drawings showing exact locations and sizes of openings through roofs, walls and floors.
4. Concrete: Conform to Concrete Section of the Specifications.

1.19 GUARANTEES

A. Contractor shall guarantee workmanship, equipment and materials installed under his contract for a period of not less than one (1) year from the date of Substantial Completion. Should any defects occur during this period, the Contractor shall promptly repair or replace the defective item and any other damage caused to the building free of charge to the Owner, including cost of labor and materials.

B. Guarantee included in this section to cover:

1. Faulty or inadequate design of equipment or material installed
2. Improper assembly or erection
3. Defective workmanship or material
4. Incorrect or inadequate operation or other failure

C. He shall guarantee the complete and perfect operation of the entire system and that equipment will be supported in such a way as to be free of objectionable vibration and noise

D. Furnish the parts and labor to replace any items found to be defective in the refrigeration equipment with the guarantee period

E. In addition to other guarantees, furnish free maintenance for the refrigeration equipment, including replacement of refrigerant and oil, for a period of one (1) year. This shall include regular monthly maintenance and "On Call" service if required.

F. For equipment bearing a manufacturer's warranty in excess of one year, furnish a copy of the warranty to the Owner, who shall be named as beneficiary.

1.20 PROTECTION OF EQUIPMENT AND MATERIALS

A. Provide adequate storage facilities for equipment and materials on the site and shall make provisions to protect such materials and equipment from damage.

1.21 CLOSING-IN OF UNINSPECTED WORK

A. Contractor shall not allow or cause any of the work, specifically ductwork and piping, to be covered up or enclosed until it has been inspected, tested, and approved by the Architect. Should any of work be covered up or enclosed before such inspection and test, he shall at his own expense, uncover the work and after it has been inspected, tested, and approved, make repairs with such materials as may be necessary to restore work to its original and proper condition.

1.22 BUILDING FOOTING CLEARANCES

A. Under no circumstances shall pipes, ducts, or conduits penetrate footings. They shall cross below footings or through sleeves above footings. Those running parallel to footings shall have the minimum clearance from the cone of influence indicated on the Drawings or as required by Code.

1.23 DAMAGE BY LEAKS

A. Contractor shall be responsible for all damage to any part of the premises caused by rain leaks through or around ducts or pipes, leaks or breaks in piping, equipment or fixtures furnished or installed by him for a period of one (1) year from the date of Substantial Completion.

1.24 EQUIPMENT LABELS

A. Equipment provided under this Section shall be provided with the manufacturer's metal identification labels attached to each individual piece of equipment showing complete performance characteristics, size, model and serial number.

1.25 EXCAVATION, TRENCHING AND BACKFILLING

A. Excavating, trenching and backfilling for utilities within the building area shall be done in conformity with Division 2 - Sitework. Piping shall be installed promptly after excavation in order to keep the trenches open as short a time as possible.

B. Excavating, trenching and backfilling for utilities outside the building area shall be done in conformity with Division 2 - Site work.

C. Any existing underground piping and conduit that is encountered shall be properly shored and protected from damage. Active piping shall be left intact and undamaged.

1.26 PRELIMINARY OPERATION

A. Should the Owner request that any portion of the plant, apparatus, or equipment be operated for the Owner's beneficial use prior to the final completion and acceptance of the work, the Contractor shall conform to Beneficial Occupancy Provisions of the General Conditions. Such operation shall be under the supervision and direction of the Contractor. Such preliminary operation shall not be construed as an acceptance of any of the work.

1.27 MAINTAINING EXISTING SERVICES

A. The premises and existing building at the site will be in use at the time the work of this Section is in progress. Contractor shall conduct his work so as to cause no inconvenience or danger to the personnel on the premises.

B. He shall maintain continuity of service to the existing mechanical systems, except for designated intervals during which connections can be made. The scheduling of the shut down period shall be at a time directed by the Architect.

C. In some instances, it may be necessary to defer work in certain areas and locations until such

time as existing facilities can be relocated or rearranged by the Owner. Therefore, whenever it becomes necessary for the Contractor to perform work under this contract in areas in which the Owner's work is being performed. This contractor shall advise the Architect relative to this requirement and shall follow closely the directive issued by the Architect insofar as time and procedure are concerned. Allow Owner 72 hours prior notice.

D. This contractor shall include in his bid all premium time to which he may be subjected for performing work in such procedure and at such time as may be necessary to cause the least interference with the function of the Owner.

1.28 ELECTRICAL WORK

A. Coordinate with Division 16 in making the line and low voltage electrical connections and be responsible for the operation of the equipment furnished under this section.

B. Voltage for electrical work will be included in Division 26. However, any control wiring which is required that is not shown on the control diagram shall be as described under this Section. In the event that the Contractor chooses to provide equipment that requires extra expense in the power or control wiring, he shall pay additional electrical costs.

C. Safety switches, starters, circuit breakers, unless provided as a portion of package equipment, and the electrical connections of mechanical equipment to the electrical power service shall be provided under Division 26.

D. Interconnecting wiring, safety switches, relays, controllers and motor starters which are integral components of packaged equipment shall be provided as an integral part of that equipment.

E. All interconnecting power wiring and conduits shall be provided by Division 26.

F. Control wiring shall be provided by Division 23, unless otherwise indicated on the drawings.

G. Conduit for control wiring shall be provided by Division 26.

END OF SECTION

SECTION 23 05 29

HANGERS AND SUPPORTS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following hangers and supports for mechanical system piping and equipment:

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Fastener systems.

B. Related Sections include the following:

1. Division 05 for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 21 Section "Fire-Suppression Piping" for pipe hangers for fire-protection piping.
3. Division 23 Section "Mechanical Vibration and Seismic Controls" for vibration isolation devices.
4. Division 23 Section "Pipe Expansion Fittings and Loops" for flexible pipe..
5. Division 23 Section "Metal Ducts" for duct hangers and supports.

1.02 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.03 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.04 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Powder-actuated fastener systems. Not allowed for this project.

B. Welding and brazing certificates.

1.05 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel." ASME Boiler and Pressure Vessel Code: Section IX.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.02 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Galvanized, Metallic Coatings: Pre-galvanized or hot dipped.

C. Nonmetallic Coatings: Plastic coating, jacket, or liner.

D. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.03 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig-minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.04 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Before Installation: Verify suitability for use in lightweight concrete or concrete slabs less than 4 inches thick with project structural engineer.

PART 3 - EXECUTION

3.01 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for bare piping for noise abatement.

F. Piping shall be concealed in chases, partitions, walls, and between floors, unless otherwise directed or specifically noted on Drawings. When penetrating wood studs, joists, and other wood members, provide such members with reinforcement steel straps of Kees Protecta-Plate.

G. For fastening to wood ceilings, beams, or joists, furnish Grinnell figure 128 or 202 pipe hanger flange fastened with drive screws. Under wood floors, 3/8 inch hanger rods shall be hung from 2 inch x 2 inch x 1/4 inch angle clips 3 inches long, with 2 staggered 10d nails, clinched over joist.

H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated stationary pipes.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 and larger, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of non-insulated stationary pipes, NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8.
9. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 2.
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of non-insulated stationary pipes, NPS 3/8 to NPS 8.
11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated stationary pipes, NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 and larger.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 and larger, with steel pipe base stanchion support and cast-iron floor flange.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 and larger, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.

16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.

I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, if longer ends are required for riser clamps.

J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    i. Light (MSS Type 31): 750 lb.
    ii. Medium (MSS Type 32): 1500 lb.
    iii. Heavy (MSS Type 33): 3000 lb.
2. Side-Beam Brackets (MSS Type 34): For sides of wooden beams.

L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

3.02 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

C. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

D. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

E. Install lateral bracing with pipe hangers and supports to prevent swaying.

F. Install building attachments. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping.

G. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

H. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

I. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.
    i. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    ii. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    iii. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    i. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    i. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
    i. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    ii. NPS 4: 12 inches long and 0.06 inch thick.
    iii. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    iv. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
5. Pipes NPS 8 and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.03 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.04 PAINTING

A. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Measurement of final operating condition of HVAC systems.

C. Commissioning activities.

1.02 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.

B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008.

C. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2002.

1.03 SUBMITTALS

A. The contractor shall procure the services of an independent Air Balance and Testing Agency, approved by the Engineer, which specializes in the balancing and testing of heating, ventilating, and air conditioning systems. The independent agency shall be certified and in good standing with the AABC.

B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.

1. Submit to Architect.
2. Submit to the Commissioning Authority.
3. Submit six weeks prior to starting the testing, adjusting, and balancing work.
4. Include certification that the plan developer has reviewed the contract documents, the equipment and systems, and the control system with Architect and other installers to sufficiently understand the design intent for each system.
5. Include at least the following in the plan:
    i. List of all air flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
    ii. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
    iii. Identification and types of measurement instruments to be used and their most recent calibration date.
    iv. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
    v. Final test report forms to be used.
    vi. Expected problems and solutions, etc.

vii. Criteria for using air flow straighteners or relocating flow stations and sensors; analogous explanations for the water side.

viii. Details of how TOTAL flow will be determined; for example:

1. Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.

ix. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and methods to verify this.

x. Confirmation of understanding of the outside air ventilation criteria under all conditions.

xi. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).

xii. Method of checking building static and exhaust fan and/or relief damper capacity.

xiii. Time schedule for deferred or seasonal TAB work, if specified.

xiv. False loading of systems to complete TAB work, if specified.

xv. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.

xvi. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).

xvii. Procedures for formal progress reports, including scope and frequency.

xviii. Procedures for formal deficiency reports, including scope, frequency and distribution.

D. Field Logs: Submit at least twice a week to the Commissioning Authority.

E. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

F. Progress Reports.

G. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

1. Submit to the the Commissioning Authority within two weeks after completion of testing, adjusting, and balancing.

2. Revise TAB plan to reflect actual procedures and submit as part of final report.

3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.

4. Include actual instrument list, with manufacturer name, serial number, and date of calibration.

5. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.

6. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.

7. Include the following on the title page of each report:

i. Name of Testing, Adjusting, and Balancing Agency.

ii. Address of Testing, Adjusting, and Balancing Agency.

iii. Telephone number of Testing, Adjusting, and Balancing Agency.

iv. Project name.

v. Project location.

vi. Project Architect.

vii. Project Engineer.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:

1. AABC (NSTSB), AABC National Standards for Total System Balance.
2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
3. SMACNA (TAB).
4. Maintain at least one copy of the standard to be used at project site at all times.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:

1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
2. Certified by the following:
   i. AABC, Associated Air Balance Council: www.aabc.com; upon completion submit AABC National Performance Guaranty.

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:

1. Systems are started and operating in a safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.

7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.03 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.04 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:

1. Running log of events and issues.
2. Discrepancies, deficient or uncompleted work by others.
3. Contract interpretation requests.
4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on the drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.05 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

G. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

H. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

I. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

J. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.02 inches negative static pressure in chemical storage rooms.

K. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

3.06 COMMISSIONING

A. Perform prerequisites prior to starting commissioning activities.

B. Include cost for commissioning requirements in the contract price.

C. Attend commissioning meetings scheduled by the CxA when requested. TAB will need to be present 2 weeks prior to the start of TAB to review the TAB plan/procedures and weekly/bi-weekly during the on-site TAB work.

D. Submit the TAB plan/procedures to the CxA for review at least two weeks prior to beginning TAB work.

E. Notify the CxA a minimum of two weeks in advance of scheduled TAB work.

F. Where applicable, complete the Certificate(s) of Acceptance per the contract documents.

1. Retain Certificate(s) of Acceptance in a 3-ring binder in an organized fashion. Binder is to remain on the job site

2. Provide copies of all Certificate(s) of Acceptance to the CxA.

3. Certificate(s) of Acceptance shall be conducted by companies who are certified as a Mechanical Acceptance Test Technician employer and only completed by those employees of said company who are certified to complete the respective acceptance test.

G. Monitor and respond to Resolution Tracking Forms distributed by the CxA in order to expedite corrective actions necessary to achieve design intent.

H. Participate in the Functional Performance Tests as required to achieve design intent.

I. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.

J. Re-check minimum outdoor air intake flows and maximum and intermediate total airflow rates for ___ percent of the air handlers plus a random sample equivalent to ____ percent of the final TAB report data as directed by Commissioning Authority.

1. Original TAB agency shall execute the re-checks, witnessed by the Commissioning Authority.

2. Use the same test instruments as used in the original TAB work.

3. Failure of more than 10 percent of the re-checked items of a given system shall result in the rejection of the system TAB report; rebalance the system, provide a new system TAB report, and repeat random re-checks.

4. For purposes of re-check, failure is defined as follows:
    i. Air Flow of Supply and Return: Deviation of more than 10 percent of instrument reading.
    ii. Minimum Outside Air Flow: Deviation of more than 20 percent of instrument reading; for inlet vane or VFD OSA compensation system using linear proportional control, deviation of more than 30 percent at intermediate supply flow.
    iii. Temperatures: Deviation of more than one degree F.
    iv. Air and Water Pressures: Deviation of more than 10 percent of full scale of test instrument reading.
    v. Sound Pressures: Deviation of more than 3 decibels, with consideration for variations in background noise.
5. For purposes of re-check, a whole system is defined as one in which inaccuracies will have little or no impact on connected systems; for example, the air distribution system served by one air handler or the hydronic chilled water supply system served by a chiller or the condenser water system.

K. In the presence of the Commissioning Authority, verify that:
1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.
2. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all terminal units taking off downstream of the static pressure sensor, the terminal unit on the critical leg has its damper 90 percent or more open.

3.07 SCOPE

A. Test, adjust, and balance the following:
1. Plumbing Pumps.
2. Forced Air Furnaces.
3. Packaged Roof Top Heating/Cooling Units.
4. Packaged Terminal Air Conditioning Units.
5. Computer Room Air Conditioning Units.
6. Fans.

END OF SECTION

SECTION 23 07 13

DUCT INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Duct liner.

C. Insulation jackets.

1.02 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

C. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2015.

D. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.

E. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2012.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

G. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

H. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Rev. 2009).

I. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

B. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 - PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturer:

1. Knauf Insulation: www.knaufinsulation.com.
2. Johns Manville: www.jm.com.
3. Owens Corning Corporation: www.ocbuildingspec.com.
4. CertainTeed Corporation: www.certainteed.com.

B. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.

2.03 GLASS FIBER, RIGID

A. Manufacturer:

1. Knauf Insulation: www.knaufinsulation.com.
2. Johns Manville: www.jm.com.
3. CertainTeed Corporation: www.certainteed.com.

B. Insulation: ASTM C612; rigid, noncombustible blanket.

1. 'K' Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
2. Governing body regulation values or as listed on the drawings as more stringent then 'K' value above, insulation value shall be superceeded with said value

C. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.

2.04 JACKETS

A. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire retardant lagging adhesive.

2.05 DUCT LINER

A. Manufacturers:

1. Knauf Insulation: www.knaufinsulation.com.
2. Johns Manville: www.jm.com.
3. CertainTeed Corporation: www.certainteed.com.

B. Insulation: Incombustible glass fiber complying with ASTM C 1071; flexible blanket, rigid

board, and preformed round liner board; impregnated surface and edges coated with poly vinyl acetate polymer or acrylic polymer shown to be fungus and bacteria resistant by testing to ASTM G 21.

1. Apparent Thermal Conductivity: Maximum of.24 at 75 degrees F.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that ducts have been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated ducts conveying air below ambient temperature:

1. Finish with tape and vapor barrier jacket.

2. Continue insulation through walls, sleeves, hangers, and other duct penetrations.

D. Insulated ducts conveying air above ambient temperature:

E. External Duct Insulation Application:

1. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.

2. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.

F. Duct and Plenum Liner Application:

1. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.

2. Seal and smooth joints. Seal and coat transverse joints.

3. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

3.03 R-VALUE FOR INSULATION ON DUCTS SHALL BE PER TITLE-24 REQUIREMENTS

END OF SECTION

SECTION 23 07 19

HVAC PIPING INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 23 23 00 - Refrigerant Piping: Placement of inserts.

1.03 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

C. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2016.

D. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2015.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

PART 2 - PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:

1. Armacell LLC: www.armacell.us.

2. K-Flex USA LLC; K-Flex Titan: www.kflexusa.com/#sle.
3. BFG Industries.
4. Rubatex: www.rbxcorp.com.
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.

1. Minimum Service Temperature: Minus 40 degrees F.
2. Maximum Service Temperature: 220 degrees F.
3. Connection: Waterproof vapor barrier adhesive.

2.03 JACKETS

A. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.

1. Thickness: 0.016 inch sheet.
2. Finish: Smooth.
3. Joining: Longitudinal slip joints and 2 inch laps.
4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature; insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

E. Install insulation on piping accessories requiring future re-occurring access and service with factory fabricated insulation covers that are easily removed and reapplied.

F. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

G. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 84 00.

H. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV resistant finish for flexible elastomeric cellular insulation without jacketing.

END OF SECTION

SECTION 23 08 02

INSTALLATION & ACCEPTANCE TESTING OF MECHANICAL SYSTEMS

PART 1 - GENERAL

1.01 INTRODUCTION

A. Title 24 requires the completion of all applicable Certificates of Installation and Certificates of Acceptance for mechanical systems. This shall include all applicable mechanical systems as defined in the energy compliance sheets included with the contract documents.

1.02 RELATED DOCUMENTS

A. Contract drawings and specifications, general provisions of the contract, including general and supplementary conditions, mechanical provisions and Division-1 Specification sections apply to work of this section.

1.03 DESCRIPTION OF WORK

A. Complete all Title 24 required Certificate(s) of Installation (NRCI) and Certificate(s) of Acceptance (NRCA) to be completed per the contract documents.

1.04 RESPONSIBILITIES OF INSTALLING CONTRACTORS

A. General Contractor (GC)

1. Ensure that all contractors identified as the contractor responsible for acceptance testing and completion of the Title 24 Certificate(s) of Acceptance are certified by the State of California or its designated body to conduct each respective test.

B. Mechanical Contractor (MC)

1. Verify proper installation and performance of all mechanical services provided.
2. Complete Title 24 Certificate(s) of Installation and manufacturer's pre-start checklists prior to scheduling startup/programming of mechanical control equipment.
    i. Retain Certificate(s) of Installation in a 3-ring binder in an organized fashion. Binder is to remain on the job site
    ii. Make Certificate(s) of Installation available for building inspector's review.
    iii. Retain calibration records for equipment provided with manufacturer calibrated sensors in the Certificate(s) of Installation binder.
    iv. Correct labeling of all circuits with connected equipment.
3. Complete the Certificate(s) of Acceptance per the contract documents.
    i. The company installing the mechanical systems must be an authorized Mechanical Controls Acceptance Test Employer certified by a Mechanical Controls Acceptance Test Technician Certification Provider or include in their bid the cost of retaining and overseeing a contractor who is an authorized Mechanical Controls Acceptance Test Employer to complete the acceptance testing.
    ii. At the discretion of the GC, the Mechanical Controls Acceptance Testing may be completed by the Testing & Balancing (T&B) Contractor if the T&B contractor's company and personnel meet all requirements in this specification section.
    iii. All required acceptance testing must be completed by a Mechanical Controls Acceptance Test Technician employed by the Mechanical Controls

Acceptance Test Employer.

iv. Retain Certificate(s) of Acceptance in a 3-ring binder in an organized fashion. Binder is to remain on the job site

v. Provide copies of all Certificate(s) of Acceptance to the GC for review by the building inspector

vi. Upload all Certificate(s) of Acceptance to the California Title 24 Certificates of Acceptance database, if, at the time of project completion, the database is available to the public.

4. Successful completion of the required Acceptance Tests is the responsibility of the installing contractor. Any costs associated with modifications necessary to obtain compliance and re-testing of systems shall be included in the base bid of this project.

END OF SECTION

SECTION 23 21 13

HYDRONIC PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Hydronic system requirements.

B. Heating water piping, above grade.

C. Pipe hangers and supports.

D. Unions, flanges, mechanical couplings, and dielectric connections.

E. Valves:

1. Ball valves.
2. Butterfly valves.
3. Check valves.

1.02 REFERENCE STANDARDS

A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.

B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.

C. ASME B31.9 - Building Services Piping; 2014.

D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

E. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2017.

F. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984 (Reapproved 2014).

G. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

H. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2016.

I. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2016.

J. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992 (Reapproved 2014).

K. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications; 2007 (Reapproved 2013).

L. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011-AMD 1.

M. AWWA C606 - Grooved and Shouldered Joints; 2015.

N. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

C. Project Record Documents: Record actual locations of valves.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 - PRODUCTS

2.01 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal, state, and local regulations.

B. Piping system shall be tested at a minimum of 125 PSI or 1.5 times the working pressure, whichever is greater per ASME B31.9 Standards.

C. Piping: Provide piping, fittings, hangers and supports as required, as indicated, and as follows:

1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
2. Use non-conducting dielectric connections whenever joining dissimilar metals.
3. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.
4. Provide pipe hangers and supports in accordance with ASME B31.9 unless indicated otherwise.

D. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges or unions to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.

E. Valves: Provide valves where indicated:

1. Isolate equipment using butterfly valves with lug end flanges or grooved mechanical couplings.
2. For throttling, bypass, or manual flow control services, use globe, ball, or butterfly valves.
3. For shut-off and to isolate parts of systems or vertical risers, use gate, ball, or butterfly valves.

2.02 HEATING WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), drawn, using one of the following joint types:

1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.
    i. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.

ii. Braze: AWS A5.8M/A5.8 BCuP copper/silver alloy.

2. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.

2.03 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.

1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

B. Conform to ASME B31.9.

C. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron, adjustable swivel, split ring.

D. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

E. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

F. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.04 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

A. Unions for Pipe 2 Inches and Less:

1. Ferrous Piping: 150 psig malleable iron, threaded.

2. Copper Pipe: Bronze, soldered joints.

B. Mechanical Couplings for Shouldered Joints:

1. Dimensions and Testing: In accordance with AWWA C606.

2. Mechanical Couplings: Comply with ASTM F1476.

3. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.

4. When pipe is field grooved, provide coupling manufacturer's grooving tools.

5. Flaring of tupe and fitting ends to IPS dimensions is not permitted

2.05 BALL VALVES

A. Manufacturers:

1. Victaulic Company: www.victaulic.com.

2. Apollo Vavles: www.apollovalves.com

B. Up To and Including 2 Inches:

1. Bronze one piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder ends with union.

2.06 BUTTERFLY VALVES

A. Manufacturers:

1. Apollo Vavles: www.apollovalves.com

2. Victaulic Valve www.victaulic.com

B. Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer, lug, or grooved ends, extended neck.

C. Disc: Construct of aluminum bronze, chrome plated ductile iron, stainless steel, ductile iron with EPDM encapsulation, Buna-N encapsulation, or _____.

D. Operator: 10 position lever handle.

2.07 SWING CHECK VALVES

A. Manufacturers:

1. Victaulic Company: www.victaulic.com.
2. Apollo Vavles: www.apollovalves.com

2.08 SPRING LOADED CHECK VALVES

A. Manufacturers:

1. Apollo Vavles: www.apollovalves.com

B. Iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer or threaded lug ends.

2.09 FLOW CONTROLS

A. Manufacturers:

1. ITT Bell & Gossett; _____: www.bellgossett.com.
2. Taco, Inc; _____: www.taco-hvac.com.
3. Apollo Vavles: www.apollovalves.com

B. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.

C. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.

PART 3 - EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

D. After completion, fill, clean, and treat systems. Refer to Section 23 25 00 for additional requirements.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Route piping in orderly manner, parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and to avoid interfere with use of space.

D. Group piping whenever practical at common elevations.

E. Sleeve pipe passing through partitions, walls and floors.

F. Slope piping and arrange to drain at low points.

G. All exposed, unfinished pipe, fittings, supports, and accessories shall be painted, all exterior piping shall have approved UV protection.

H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 22 05 16.

I. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-58.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

J. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 19.

K. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 31 00.

L. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting. Refer to Section 09 91 23.

END OF SECTION

SECTION 23 21 14

HYDRONIC SPECIALTIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Air vents.

B. Strainers.

C. Pressure-temperature test plugs.

D. Combination flow controls.

E. Relief valves.

1.02 SUBMITTALS

A. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description and model.

B. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

C. Project Record Documents: Record actual locations of flow controls.

D. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 - PRODUCTS

2.01 AIR VENTS

A. Manufacturers:

1. Armstrong International, Inc: www.armstronginternational.com.
2. ITT Bell & Gossett: www.bellgossett.com.
3. Taco, Inc: www.taco-hvac.com.

B. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.

C. Float Type:

1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.
2. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system

operating temperature and pressure; with isolating valve.

2.02 STRAINERS

A. Manufacturers:

1. Armstrong International, Inc: www.armstronginternational.com.

B. Size 2 inch and Under:

1. Screwed brass or iron body for 175 psi working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

2.03 PRESSURE-TEMPERATURE TEST PLUGS

A. Manufacturers:

1. Ferguson Enterprises Inc: www.fnw.com.
2. Peterson Equipment Company Inc: www.petesplug.com.

B. Construction: Brass body designed to receive temperature or pressure probe with removable protective cap, and Neoprene rated for minimum 200 degrees F.

C. Application: Use extended length plugs to clear insulated piping.

2.04 COMBINATION FLOW CONTROLS

A. Manufacturers:

1. ITT Bell & Gossett; _____: www.bellgossett.com.

B. Construction: Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet with blowdown/backflush drain.

C. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.

D. Control Mechanism: Stainless steel or nickel plated brass piston or regulator cup, operating against stainless steel helical or wave formed spring.

2.05 RELIEF VALVES

A. Manufacturers:

1. Armstrong International, Inc: www.armstronginternational.com.
2. ITT Bell & Gossett: www.bellgossett.com.

B. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

PART 3 - EXECUTION

3.01 INSTALLATION

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

B. Where large air quantities can accumulate, provide enlarged air collection standpipes.

C. Provide manual air vents at system high points and as indicated.

D. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

E. Pipe relief valve outlet to nearest floor drain.

F. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.

END OF SECTION

SECTION 23 22 13

STEAM AND STEAM CONDENSATE PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pipe and pipe fittings.

B. Pipe hangers and supports.

C. Steam piping system.

1.02 RELATED REQUIREMENTS

A. Section 08 31 00 - Access Doors and Panels.

B. Section 09 91 23 - Interior Painting.

C. Section 23 25 00 - HVAC Water Treatment: Pipe cleaning.

1.03 REFERENCE STANDARDS

A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.

B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.

C. ASME B31.1 - Power Piping; 2016.

D. ASME B31.9 - Building Services Piping; 2014.

E. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

F. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2016.

G. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2016.

H. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992 (Reapproved 2014).

I. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011-AMD 1.

J. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

1.04 SYSTEM DESCRIPTION

A. When more than one piping system material is selected, ensure systems components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, unions, and couplings for servicing are consistently provided.

B. Use unions and flanges downstream of valves and at equipment or apparatus connections. Use dielectric unions where joining dissimilar materials. Do not use direct welded or threaded connections.

C. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.

D. Use gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories. Provide

manufacturers catalogue information. Indicate valve data and ratings.

C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

D. Project Record Documents: Record actual locations of valves.

E. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Valve Repacking Kits: One for each type and size of valve.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labelling in place. Inspect for damage.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 - PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Conform to ASME B31.9 and ASME B31.1 code for installation of piping system.

2.02 LOW PRESSURE STEAM PIPING (15 PSIG MAXIMUM)

A. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn.

1. Fittings: ASME B16.18, cast brass, or ASME B16.22 wrought copper.
2. Joints: Solder, lead free, ASTM B32, HB alloy (95-5 tin-antimony), or tin and silver.

2.03 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.

1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

B. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron, adjustable swivel, split ring.

C. Hangers for Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis.

D. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

E. Vertical Support: Steel riser clamp.

F. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

G. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.04 UNIONS, FLANGES, AND COUPLINGS

A. Unions for Pipe 2 Inches and Under:

1. Copper Pipe: Bronze, soldered joints.

PART 3 - EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Whenever work is suspended during construction protect open ends with temporary plugs or caps.

E. After completion, fill, clean, and treat systems. Refer to Section 23 25 00.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Route piping in orderly manner, plumb and parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and avoid interference with use of space.

D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

E. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9.
2. Support horizontal piping as indicated.
3. Place hangers within 12 inches of each horizontal elbow.
4. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
5. Provide copper plated hangers and supports for copper piping.

F. Provide clearance for installation of insulation and access to valves and fittings.

G. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 31 00.

H. Slope steam piping one inch in 40 feet in direction of flow. Use eccentric reducers to maintain bottom of pipe level.

I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

J. Prepare unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 91 23.

END OF SECTION

SECTION 23 22 14

STEAM AND CONDENSATE HEATING SPECIALTIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Steam traps.

B. Steam air vents.

C. Steam safety valves.

1.02 REFERENCE STANDARDS

A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; 2015.

B. ASME B31.9 - Building Services Piping; 2014.

C. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2014).

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data:

1. Provide for manufactured products and assemblies required for this project.
2. Include product description, model, dimensions, component sizes, rough-in requirements, service sizes, and finishes.
3. Submit schedule indicating manufacturer, model number, size, location, rated capacity, load served, and features for each specialty.
4. Include electrical characteristics and connection requirements.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with State of California standard for installation of boilers and pressure vessels.

B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 - PRODUCTS

2.01 STEAM TRAPS

A. Manufacturers:

1. Armstrong International, Inc: www.armstronginternational.com.

2. Spirax-Sarco: www.spiraxsarco.com/us.

B. Steam Trap Applications:

1. Use Float and Thermostatic Traps for:

i. Direct steam injected equipment.

2. Use Inverted Bucket Steam Traps for:

i. Direct steam injected equipment.

C. Steam Trap Performance:

1. Select to handle minimum of two times maximum condensate load of apparatus served.

2. Pressure Differentials:

i. Low Pressure Systems (5 psi and less): 1/4 psi.

D. Inverted Bucket Traps: ASTM A126, cast iron or semi-steel body with bolted cover, brass bucket, stainless steel seats and plungers, and stainless steel lever mechanism with knife edge operating surfaces.

1. Rating: 60 psi WSP.

2. Features: Access to internal parts without disturbing piping, top test plug, bottom drain plugs.

3. Accessories:

i. Integral inlet strainer of brass.

ii. Integral inlet check valve.

iii. Integral bimetal air vent.

E. Float and Thermostatic Traps: ASTM A126 cast iron or semi-steel body and bolted cover, stainless steel or bronze bellows type air vent, stainless steel or copper float, stainless steel lever and valve assembly.

1. Rating: 15 psi WSP.

2. Features: Access to internal parts without disturbing piping, bottom drain plug.

3. Accessories: Gage glass with shut-off cocks.

2.02 STEAM AIR VENTS

2.03 SAFETY RELIEF VALVES

A. Manufacturers:

1. Armstrong International, Inc: www.armstronginternational.com.

2. ITT McDonnell & Miller, a xylem brand: www.mcdonnellmiller.com.

3. Spirax-Sarco: www.spiraxsarco.com/us.

B. Valve: Bronze body, stainless steel valve spring, stem, and trim, direct pressure actuated, capacities ASME certified and labelled.

C. Accessories: Drip pan elbow.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install steam piping and specialties in accordance with ASME B31.9.

B. Install specialties in accordance with manufacturer's instructions.

C. Steam Traps:

1. Provide minimum 3/4 inch size on steam mains and branches.
2. Install with union or flanged connections at both ends.
3. Provide gate valve and strainer at inlet, and gate valve and check valve at discharge.
4. Provide minimum 10 inch long, line size dirt pocket between apparatus and trap.

END OF SECTION

SECTION 23 23 00

REFRIGERANT PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Piping.

B. Refrigerant.

C. Moisture and liquid indicators.

D. Valves.

E. Filter-driers.

F. Solenoid valves.

G. Expansion valves.

1.02 REFERENCE STANDARDS

A. AHRI 710 - Performance Rating of Liquid-Line Driers; 2009.

B. AHRI 750 - Thermostatic Refrigerant Expansion Valves; 2007.

C. AHRI 760 - Performance Rating of Solenoid Valves for Use With Volatile Refrigerants; 2007.

D. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2013.

E. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.

F. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; 2013.

G. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; 2013.

H. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2016.

I. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2016.

J. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2016.

K. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011-AMD 1.

L. UL 429 - Electrically Operated Valves; Current Edition, Including All Revisions.

1.03 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

B. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.

C. Liquid Indicators:

1. Use line size liquid indicators in main liquid line leaving condenser.

D. Valves:

1. Use service valves on suction and discharge of compressors.
2. Use gage taps at compressor inlet and outlet.

E. Filter-Driers:

1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.

F. Solenoid Valves:

1. Use in liquid line of single or multiple evaporator systems.

1.04 SUBMITTALS

A. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.

B. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties in shipping containers with labeling in place.

B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 - PRODUCTS

2.01 PIPING

A. Copper Tube: ASTM B280, H58 hard drawn or O60 soft annealed.

1. Fittings: ASME B16.22 wrought copper.

2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.

B. Copper Tube to 7/8 inch OD: ASTM B88 (ASTM B88M), Type K (A), annealed.

1. Fittings: ASME B16.26 cast copper.

2. Joints: Flared.

C. Pipe Supports and Anchors:

1. Conform to ASME B31.5.

2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron adjustable swivel, split ring.

2.02 MOISTURE AND LIQUID INDICATORS

A. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

2.03 VALVES

A. Service Valves:

1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psi.

2.04 FILTER-DRIERS

A. Performance:

1. Flow Capacity - Liquid Line: per manufactures recommendation, minimum, rated in accordance with AHRI 710.

2. Pressure Drop: 2 psi, maximum, when operating at full connected evaporator capacity.

3. Design Working Pressure: per manufactures recommendation, minimum.

B. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of

construction that will not pass into refrigerant lines.

C. Construction: UL listed.

1. Connections: As specified for applicable pipe type.

2.05 SOLENOID VALVES

A. Valve: AHRI 760 I-P, pilot operated, copper, brass or steel body and internal parts, synthetic seat, stainless steel stem and plunger assembly (permitting manual operation in case of coil failure), integral strainer, with flared, solder, or threaded ends; for maximum working pressure of 500 psi.

B. Coil Assembly: UL 429, UL listed, replaceable with molded electromagnetic coil, moisture and fungus proof, with surge protector and color coded lead wires, integral junction box with pilot light.

PART 3 – EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and avoid interference with use of space.

D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

E. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.5.

2. Support horizontal piping as indicated.

3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

4. Place hangers within 12 inches of each horizontal elbow.

F. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

G. Provide clearance for installation of insulation and access to valves and fittings.

H. Provide access to concealed valves and fittings. Coordinate size and location of access doors with Section 08 31 00.

I. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.

J. Refrigerant piping shall be provided with insulation. All exterior insulation shall be provided with an aluminum jacket and UV protection.

END OF SECTION

SECTION 23 31 00

HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Metal ductwork.

B. Nonmetal ductwork.

C. Casing and plenums.

1.02 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

D. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2015.

E. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Rev. 2009).

F. SMACNA (FGD) - Fibrous Glass Duct Construction Standards; 2003.

G. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

1.03 PERFORMANCE REQUIREMENTS

A. No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.04 SUBMITTALS

A. Product Data: Provide data for duct materials, duct liner, and duct connections.

B. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

1.06 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 - PRODUCTS

2.01 DUCT ASSEMBLIES

A. Regulatory Requirements: Construct ductwork to NFPA 90A standards.

2.02 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.

B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.

1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.

2. VOC Content: Not more than 250 g/L, excluding water.

3. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.

C. Flexible Ducts:

1. UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound spring steel wire.

a. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.

b. Maximum Velocity: 4000 fpm.

c. Temperature Range: -20 degrees F to 210 degrees F.

D. Insulated Flexible Ducts:

1. UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound spring steel wire; fiberglass insulation; polyethylene vapor barrier film.

a. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.

b. Maximum Velocity: 4000 fpm.

c. Temperature Range: -20 degrees F to 210 degrees F.

E. Low Pressure Supply (System with Cooling Coils): 1 inch w.g. pressure class, galvanized steel.

F. Medium and High Pressure Supply: 6 inch w.g. pressure class, galvanized steel.

G. Return and Relief: 1 inch w.g. pressure class, galvanized steel.

H. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.

I. Hanger Rod: ASTM A 36/A 36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.03 DUCTWORK FABRICATION

A. Fabricate ductwork gauge in accordence with current (CMC) California Mechanical Code and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

C. T's, bends, and elbows: Construct according to (CMC) California Mechanical Code and SMACNA (DCS).

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

F. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

G. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.04 DUCT MANUFACTURERS

A. Metal-Fab, Inc: www.mtlfab.com.

B. SEMCO Incorporated: www.semcoinc.com.

C. United McGill Corporation: www.unitedmcgill.com.

2.05 MANUFACTURED DUCTWORK AND FITTINGS

A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages,reinforcing, and sealing for operating pressures indicated.

B. Flexible Ducts: Black polymer film supported by helically wound spring steel wire.

1. Pressure Rating: 4 inches WG positive and 0.5 inches WG negative.

2. Maximum Velocity: 4000 fpm.

3. Temperature Range: Minus 20 degrees F to 175 degrees F.

C. Fume Hood Exhaust: Minimum 21 gage, 0.0344 inch thick, single wall, Type 316 stainless steel.

1. Single wall, factory built chimney liner system.

2. Designed, fabricated, and installed to be liquid tight preventing exhaust leakage into the building.

3. Joints to be sealed during installation with factory supplied overlapping V-bands and sealant.

4. Manufacturers:

a. AMPCO by Hart & Cooley, Inc.; Model N: www.ampcostacks.com.

b. Selkirk Corporation; Model G: www.selkirkcommercial.com.

2.06 CASINGS

A. Fabricate casings in accordance with SMACNA (DCS) and construct for operating pressures indicated.

B. Mount floor mounted casings on 4 inch high concrete curbs. At floor, rivet panels on 8 inch centers to angles. Where floors are acoustically insulated, provide liner of galvanized 18 gage, 0.0478 inch expanded metal mesh supported at 12 inch centers, turned up 12 inches at sides with sheet metal shields.

C. Mount floor mounted casings on 4 inch high concrete curbs. At floor, rivet panels on 8 inch centers to angles. Where floors are acoustically insulated, provide liner of 18 gage galvanized expanded metal mesh supported at 12 inch centers, turned up 12 inches at sides with sheet metal shields.

D. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection.

E. Fabricate acoustic casings with reinforcing turned inward. Provide 16 gage, 0.0598 inch sheet steel back facing and 22 gage, 0.0299 inch perforated sheet steel front facing with 3/32 inch diameter holes on 5/32 inch centers. Construct panels 3 inches thick packed with 4.5 lb/cu ft minimum glass fiber insulation media, on inverted channels of 16 gage, 0.0598 inch sheet steel.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install in accordance with manufacturer's instructions.

C. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

D. Install and seal metal and flexible ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

E. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

F. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

G. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.

H. Use double nuts and lock washers on threaded rod supports.

I. Connect terminal units to supply ducts directly or with one foot maximum length of flexible duct. Do not use flexible duct to change direction.

J. Connect diffusers or light troffer boots to low pressure ducts with 7 feet maximum length of flexible duct held in place with strap or clamp.

K. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

L. At exterior wall louvers, seal duct to louver frame and install blank-out panels.

END OF SECTION

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Air turning devices/extractors.

B. Backdraft dampers - metal.

C. Combination fire and smoke dampers.

D. Duct access doors.

E. Duct test holes.

F. Fire dampers.

G. Flexible duct connections.

H. Smoke dampers.

I. Volume control dampers.

1.02 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

B. NFPA 92 - Standard for Smoke Control Systems; 2015.

C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Rev. 2009).

D. UL 33 - Safety Heat Responsive Links for Fire-Protection Service; Current Edition, Including All Revisions.

E. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.

F. UL 555S - Standard for Smoke Dampers; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. Product Data: Provide for shop fabricated assemblies including volume control dampers, duct access doors, and hardware used. Include electrical characteristics and connection requirements.

B. Manufacturer's Installation Instructions: Provide instructions for fire dampers and combination fire and smoke dampers.

1.04 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 - PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

A. Manufacturers:

1. Krueger-HVAC, Division of Air System Components: www.krueger-hvac.com.

2. PCI Industries, Inc; Pottorff Brand : www.portorff.com.
3. Ruskin Company, a brand of Johnson Controls: www.ruskin.com.
4. Titus HVAC, a brand of Johnson Controls: www.titus-hvac.com.

B. Multi-blade device with radius blades attached to pivoting frame and bracket, steel construction, with worm drive mechanism with removable key operator.

2.02 BACKDRAFT DAMPERS - METAL

2.03 BACKDRAFT DAMPERS

A. Manufacturers:
1. Nailor Industries, Inc: www.nailor.com.
2. PCI Industries, Inc; Pottorff Brand : www.portorff.com.
3. Ruskin Company, a brand of Johnson Controls: www.ruskin.com.

B. Gravity Backdraft Dampers, Size 18 by 18 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.

2.04 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:
1. PCI Industries, Inc; Pottorff Brand : www.portorff.com.
2. Ruskin Company, a brand of Johnson Controls: www.ruskin.com.

B. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.

C. Provide factory sleeve and collar for each damper.

D. Operators: UL listed and labelled spring return electric type suitable for 120 volts, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on interior of duct and link to damper operating shaft.

2.05 DUCT ACCESS DOORS

A. Manufacturers:
1. Nailor Industries, Inc: www.nailor.com.
2. Ruskin Company, a brand of Johnson Controls: www.ruskin.com.
3. SEMCO LLC: www.semcohvac.com.
4. Substitutions: See Section 01 60 00 - Product Requirements.

2.06 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

2.07 FIRE DAMPERS

A. Manufacturers:
1. PCI Industries, Inc; Pottorff Brand : www.portorff.com.
2. Ruskin Company, a brand of Johnson Controls: www.ruskin.com.

B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

C. Ceiling Dampers: Galvanized steel, 22 gage frame and 16 gage flap, two layers 0.125 inch ceramic fiber on top side and one layer on bottom side for round flaps, with locking clip.

D. Horizontal Dampers: Galvanized steel, 22 gage frame, stainless steel closure spring, and

lightweight, heat retardant non-asbestos fabric blanket.

E. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

2.08 FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Flexible Duct Connections: Fabric crimped into metal edging strip.

2.09 SMOKE DAMPERS

A. Manufacturers:

1. PCI Industries, Inc; Pottorff Brand : www.portorff.com.
2. Ruskin Company, a brand of Johnson Controls: www.ruskin.com.

B. Fabricate in accordance with NFPA 90A and UL 555S, and as indicated.

2.10 VOLUME CONTROL DAMPERS

A. Manufacturers:

1. Nailor Industries, Inc: www.nailor.com.
2. PCI Industries, Inc; Pottorff Brand : www.portorff.com.
3. Ruskin Company, a brand of Johnson Controls: www.ruskin.com.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.

D. Quadrants:

1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 31 00 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated. Provide 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.

D. Provide duct test holes where indicated and required for testing and balancing purposes.

E. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by Authorities Having Jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

F. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.

G. Demonstrate re-setting of fire dampers to Owner's representative.

H. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

I. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

J. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

SECTION 23 34 23

HVAC POWER VENTILATORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Roof exhausters.

B. Utility vent set.

1.02 REFERENCE STANDARDS

A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; http://www.amca.org/certified/search/company.aspx.

B. AMCA 99 - Standards Handbook; 2010.

C. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2005.

D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2007.

E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; 2014.

F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2014.

G. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2014.

H. UL 705 - Power Ventilators; Current Edition, Including All Revisions.

I. UL 762 - Outline of Investigation for Power Roof Ventilators for Restaurant Exhaust Appliances; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

B. Manufacturer's Instructions: Indicate installation instructions.

1.04 FIELD CONDITIONS

A. Permanent ventilators may not be used for ventilation during construction.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Greenheck Fan Corporation: www.greenheck.com.

B. Loren Cook Company: www.lorencook.com.

2.02 POWER VENTILATORS - GENERAL

A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.

B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.

C. Sound Ratings: AMCA 301, tested to AMCA 300 and bearing AMCA Certified Sound Rating Seal.

D. Fabrication: Conform to AMCA 99.

E. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

F. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

G. Kitchen Hood Exhaust Fans: Comply with requirements of NFPA 96 and UL 762.

2.03 ROOF EXHAUSTERS

A. Fan Unit: Direct driven as indicated, with spun aluminum housing; resilient mounted motor; 1/2 inch mesh, 0.62 inch thick aluminum wire birdscreen; hinged square base to suit roof curb with continuous curb gaskets.

B. Roof Curb: 12 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips.

C. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor.

D. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked.

E. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.04 UTILITY VENT SET

A. Manufacturers:

1. Greenheck Fan Corporation: www.greenheck.com.
2. Loren Cook Company: www.lorencook.com.

B. Direct Drive Fan:

1. Fan Wheel:
   i. Type: Non-overloading, backward inclined centrifugal.
   ii. Material: Aluminum.
2. Statically and dynamically balanced.
3. Motors:
   i. Open drip-proof (ODP).
   ii. Heavy duty ball bearing type.
   iii. Mount on vibration isolators or resilient cradle mounts, out of air stream.
   iv. Fully accessible for maintenance.
   v. OSHA weather cover.
   vi. Extended lube lines.
4. Housing:
   i. Construct of heavy gage steel with phenolic epoxy UV light gray coating.
   ii. Rigid internal support structure.
   iii. Steel hinged access door.
   iv. Curb cap and inlet box.

v. Steel drain.

vi. Roof Curb.

C. Shafts and Bearings:

1. Fan Shaft:

i. Ground and polished stainless steel with anti-corrosive coating.

ii. Rub ring.

iii. First critical speed at least 25 percent over maximum cataloged operating speed.

2. Bearings:

i. Permanently sealed or pillow block type.

ii. Minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.

iii. 100 percent factory tested.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure roof exhausters with cadmium plated steel lag screws to roof curb.

C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.

D. Provide sheaves required for final air balance.

E. Install backdraft dampers on inlet to roof and wall exhausters.

3.02 SCHEDULES SHOWN ON SHEET M-0.1

END OF SECTION

SECTION 23 37 00

AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Diffusers.

B. Registers/grilles.

1.02 REFERENCE STANDARDS

A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2012.

B. ARI 890 - Standard for Air Diffusers and Air Diffuser Assemblies; Air-Conditioning and Refrigeration Institute; 2008.

C. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets; 2006 (R2011).

D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Rev. 2009).

1.03 SUBMITTALS

A. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.04 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Krueger: www.krueger-hvac.com.

B. Price Industries: www.price-hvac.com.

C. Titus: www.titus-hvac.com.

2.02 RECTANGULAR CEILING DIFFUSERS

A. Type: Square, stamped, multi-core diffuser to discharge air in 360 degree pattern with sectorizing baffles where indicated.

B. Frame: Surface mount type. In plaster ceilings, provide plaster frame and ceiling frame.

C. Fabrication: Aluminum with baked enamel off-white finish.

2.03 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with blades set at 45 degrees, vertical face.

B. Frame: 1-1/4 inch margin with countersunk screw mounting.

C. Fabrication: Aluminum extrusions, with factory baked enamel finish.

D. Color: As indicated.

E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face where not individually connected to exhaust fans.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

3.02 SCHEDULES SHOWN ON SHEET M-0.1

END OF SECTION

SECTION 26 00 10

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SCOPE

A. This section supplements all sections of this division and shall apply to all phases of work hereinafter specified, shown on the drawings, or required to provide a complete installation of electrical systems for the Project. The work required under this division is not limited to the electrical specifications and drawings. Refer to all bid documents including Civil, Architectural, Structural, and Mechanical documents which may designate Work to be accomplished. The intent of the Specifications is to provide a complete and operable electrical system, which shall include all documents that are a part of the entire Project Contract.

1. Work included: Furnish all labor, material, tools, equipment, facilities, transportation, skilled supervision necessary for, and incidental to, performing operations in connection with furnishing, delivery, and installation of the work in this division complete as shown or noted on the Drawings and specified herein.

B. Related Work Specified Elsewhere:

1. Refer to all sections in the general contract conditions, Contract Requirements and Division 1, General Requirements.

C. Work Installed but Furnished by Others:

1. The electrical work includes the installation or connection of certain materials and equipment furnished by others. Verify installation details. Foundations for apparatus and equipment will be furnished by others unless otherwise noted or detailed.

1.02 GENERAL REQUIREMENTS

A. Guarantee See General Conditions:

1. Except as may be specified under other Sections in the specification, guarantee equipment furnished under the specifications for a period of one year, except for equipment required to have a longer guarantee period, from date of final completion. Guarantee all work against defective workmanship, material, and improper installation. Upon notification of failure, correct deficiency immediately and without additional cost to the Owner.

2. Standard warranty of manufacturer shall apply for replacement of parts after expiration of the above period. Manufacturer shall furnish replacement parts to the Owner or his service agency as approved. Furnish to the Owner, through the Architect, printed manufacturer's warranties complete with material included and expiration dates, upon completion of project. Conform to Division 01.

B. Equipment Safety: All electrical materials and equipment shall be new and shall be listed by Underwriter's Laboratories and bear their label, or listed and certified by a nationally recognized testing authority where UL does not have an approval. Custom made equipment must have complete test data submitted by the manufacturer attesting to its safety.

C. Codes and Regulations:

1. Design, manufacturer, testing and method of installation of all apparatus and materials furnished under the requirements of these specifications shall conform to the latest publications or standard rules of the following:

i. Institute of Electrical and Electronic Engineers - IEEE

ii. National Electrical Manufacturers' Association - NEMA
iii. Underwriters' Laboratories, Inc. - UL
iv. National Fire Protection Association - NFPA
v. American Society for Testing and Materials - ASTM
vi. American National Standards Institute - ANSI
vii. California Electrical Code - CEC, Title 24, Part 3
viii. California Code of Regulations, Title 8, Subchapter 5
ix. California Building Code-CBC, Title 24 Parts 1 &2
x. State & Municipal Codes in Force in the Specific Project Area
xi. Occupational Safety & Health Administration - OSHA
xii. California State Fire Marshal
xiii. California Fire Code- CFC, Title 24 Part 9
xiv. National Electrical Testing Association - NETA

2. The term "Code", when used within the specifications, shall refer to the Publications, Standards, ordinances and codes, listed above. In the case where the codes have different levels of requirements the most stringent rules shall apply.

D. Requirements of Regulatory Agencies:

1. Codes, Permits, and Fees: Where the Contract Documents exceed minimum requirements, the Contract Documents take precedence. Where code conflicts occur, the most stringent shall apply. The most stringent condition shall be as interpreted by the Engineer.

i. Comply with all requirements for permits, licenses, fees and Code. Permits, licenses, fees, inspections and arrangements required for the Contractor at his expense shall obtain the Work, unless otherwise specified.

ii. Comply with the requirements of the applicable utility companies serving the Project. Make all arrangements with the utility companies for proper coordination of the Work.

E. Shop Drawings:

1. See Division 01 for additional requirements.

2. Time Schedules for Submission and Ordering: The Contractor shall prepare, review and coordinate his schedule of submissions carefully, determining the necessary lead time for preparing, submitting, checking, ordering and delivery of materials and equipment for timely arrival. The Contractor shall be responsible for conformance with the overall construction schedule.

3. Submittals will be checked for general compliance with specifications only. The Contractor shall be responsible for deviations from the drawings or specifications and for errors or omissions of any sort in submittals.

4. Submit a complete list of materials and equipment proposed for the job, including manufacturers names and catalog numbers.

5. Shop drawings shall be submitted in completed groups of materials (i.e., lighting fixtures or switchgear). The Contractor shall add and sign the following paragraph on equipment and materials submitted for review. "It is hereby certified that the (equipment) (material) shown and marked in this submittal is that proposed to be incorporated into the project; is in compliance with the Contract Drawings and

specifications and can be installed in the allocated spaces". Failure to add the above written statement for compliance will result in return of submittals without review.

i. Bind catalog cuts, plate numbers, descriptive bulletins and drawings, 11" x 17" (275 mm x 435 mm) or smaller, in sets with covers neatly showing titles.

ii. The Contractor shall verify dimensions of equipment and be satisfied as to Code compliance for fit prior to submitting shop drawings for approval.

iii. Where current limiting devices are specified, submit technical data to substantiate adequate protection of equipment cascaded downstream. Submittals shall not be reviewed unless supporting calculations and data are submitted therewith.

iv. Include complete catalog information such as construction, ratings, insulation systems, as applicable.

v. For any material specified to meet UL or trade standards, furnish the manufacturers or vendor's certification that the material furnished for the work does in fact equal or exceed such specifications.

vi. Reference listings to the specifications' Sections and Article to which each is applicable.

vii. Equipment Floor Plans: After approval of material is secured prepare a floor plan of each electrical and communication equipment space, room or yard, drawn to scale at 1/2 inch equals 1 foot and submit for approval in the same manner as for shop drawings. The layout drawings shall be exact scale.

6. Contractor shall prepare coordinated drawings when required by Division 01 or where noted otherwise.

F. Interpretations: The Contractor through the Architect must make Requests for interpretations of drawings and specifications. Any such requests made by equipment manufacturers or suppliers will be referred to the Contractor.

G. Standard of Quality

1. The contract Drawings and Specifications establish the “MINIMUM STANDARD OF QUALITY” each product and/or system must meet to be considered acceptable. Products of other manufactures will be considered if the product and/or system meet or exceed the “MINIMUM STANDARD OF QUALITY” established by this Contract Document.
2. Items for similar application shall be of the same manufacturer.
3. The label of listing by UL shall appear on all materials and equipment for which standards have been established by the agency.
4. Where codes as listed in Section General Requirement Section of the Specifications that establish label or approved requirements, furnish all materials and equipment with either the required labels affixed or the necessary written approval.
5. Provide the type and quantity of electrical materials and equipment necessary to complete Work and all systems in operation, tested and ready for use.
6. Provide and install all incidental items that belong to the Work described and which are required for complete systems.
7. All switchboards, distribution boards, panel boards and circuit breakers shall be of the same manufacturer.
8. All wiring devices such as switches and receptacles shall be of the same manufacturer.

H. Substitutions: Refer to Division 01

I. Submit comprehensive material list, shop drawings and complete technical data for the following equipment and materials:

1. General Requirements:

i. Main service and distribution switchboards.

ii. Panelboards.

iii. Conduits

iv. Conductors, include all selected insulation types.

v. Fuses

vi. Disconnect switches and Starters.

vii. Pullboxes, manholes and handholes.

viii. Standard lighting fixtures, specially fabricated fixtures, ballasts and lamps, with samples and sample of standard finish available (where requested).

ix. Control devices, standard and special receptacles, switches, outlets and finish device plates.

x. Cabinets for signal and telephone system, special terminals and cabinets. Include all cabinet dimensions.

xi. Fire alarm system.

xii. Transformers

J. Record Drawings: Refer to Division 01, Contract Closeout.

K. Work Responsibilities:

1. The drawings indicate diagrammatically the desired locations or arrangement of conduit runs, outlets, junction boxes and equipment and are to be followed. Execute the work so as to secure the best possible installation in the available space and to overcome local difficulties due to space limitations. The Contractor is responsible for the correct placing of his work. Where conflicts occur in plans and/or specifications, the most stringent application shall apply and shall be part of the base bid.

2. Locations shown on architectural plan or on wall elevations shall take precedence over electrical plan locations, but where a major conflict is evident, notify the Architect.

3. In the event minor changes in the indicated locations or arrangement are necessary due to developed conditions in the building construction or rearrangement of furnishings or equipment or due to interference with other trades, such changes shall be made without extra cost.

4. Verify dimensions and the correct location of Owner-Furnished equipment before proceeding with the roughing-in of connections.

5. All scaled and figured dimensions are approximate of typical equipment of the class indicated. Before proceeding with work carefully check and verify dimensions and sizes with the drawings to see that the furnished equipment will fit into the spaces provided without violation of applicable Codes.

6. Should any changes to the work indicated on the drawings or described in the specifications be necessary in order to comply with the above requirements, notify the Architect.

7. Contractor shall be responsible for coordination of coordinated drawings when

required by the Architect.

8. Replace or repair, without additional compensation any work which does not comply with or which is installed in violation of any of these requirements.

L. Installation General: For special requirements, refer to specific equipment under these requirements.

1. Unless otherwise specified elsewhere in the specifications, do all excavating necessary for the proper installation of the electrical work.

2. Locations of Openings: Locate chases, shafts and openings required for the installation of the electrical work during framing of the structure. Do any additional cutting and patching required. Cutting or drilling in any structural member is prohibited without approval of the Architect. Furnish all access panels to make all boxes, connections and devices accessible as required by CEC.

3. Location of Sleeves: Where conduits pass through concrete walls, suspended slabs or metal deck floors, install sleeves of adequate size to permit installation of conduit. Sleeves shall be installed prior to pouring of concrete and shall have ends flush with the wall or extend 2 inches above floor surfaces. Verify locations.

4. Wherever conduit extends through roof, install flashings in accordance with drawings and details.

5. Contractor shall be responsible for cutting and patching which may be required for the proper installation of the electrical work.

6. Protect work, materials and equipment and provide adequate and proper storage facilities during the progress of the work. Storage outdoors shall be weather protected and shall include space heaters to prevent condensation. Provide for the safety and good condition of all work until final acceptance of the work. Replace all damaged or defective work, materials and equipment before requesting final acceptance.

7. Conduit and Equipment to be Installed: Clean thoroughly to remove plaster, spattered paint, cement and dirt on both exterior and interior. All underground conduits shall be mandrelled prior to pulling wire.

8. Conduit and Equipment to be Painted: Clean conduit exposed to view in completed structure by removing plaster and dirt. Remove grease, oil and similar material from conduit and equipment by wiping with clean rags and suitable solvents in preparation for paint.

9. Items with Factory Finish: Remove cement, plaster, grease and oil, and leave surfaces, including cracks and corners, clean and polished. Touch up scratched or bare spots to match finish.

10. Site Cleaning: Remove from site all packing cartons, scrap materials and other rubbish on a weekly basis. Vacuum out all cabinets, switchgear and panels and junction boxes prior to pulling any conductors.

11. Electrical equipment and materials exposed to public and in finished areas shall be finish-painted after installation in accordance with the Painting Section. All exposed screw-type fasteners, exterior, or interior in restrooms, shall be vandal-resistant spanner type; include tool.

M. Excavation, Cutting and Patching:

1. Excavating, trenching and backfilling required for the work of this Division in accordance with the applicable requirements of Division 2. Excavating and backfilling connected with electrical work, repaving cuts and providing and maintaining protective measures for the electrical work excavation required by the

governing authorities having jurisdiction shall be performed as a part of the work of this Division.

2. Verify openings indicated on the drawings. Provide all cutting, patching and reinforcement of the construction of the building as required to install electrical work.

N. Tests

1. Equipment and systems for which the National Electrical Testing Association (NETA) has an approved or recommended procedure, shall be tested in accordance with that procedure. Test values shall equal values recommended by NETA. Copies of test reports shall be submitted as required under shop drawing submittals.

2. Resistance to ground tests shall be accomplished by a qualified independent testing firm to measure resistance to ground at grounding electrodes. Make tests before slabs or affected areas are poured in order that corrective measures, if required, may be taken. Submit a report showing the results of these measurements. If the resistances exceed values specified elsewhere or NETA test procedure recommendations, perform corrective measures required to reduce resistance to acceptable values.

3. Prior to energizing any motor, measure the service voltage for phase balance and report if unbalance exceeds 1% from mean.

4. Measure the three-phase voltage at no load and at maximum load conditions and submit to the engineer a report showing the results of these measurements.

5. Upon completion of the work and adjustment of all equipment, conduct an operating test. Conduct the test in the presence of an authorized representative of the Owner's Representative. Demonstrate system and equipment to operate in accordance with requirements of the Contract Documents and to be free from electrical and mechanical defects. Provide systems free from short circuits and grounds and show an insulation resistance between phase conductors and ground not less than the requirements of the governing electric code. Test circuits for proper neutral connection.

6. Complete tests prior to final inspection of project, including corrective work based on the results of the tests.

7. Perform special tests on systems and equipment as specified herein using personnel qualified to perform such tests.

O. Protection: Protect finish parts of the materials and equipment against damage during the progress of the work and until final completion and acceptance. Cover materials and equipment in storage and during construction in such a manner that no finished surfaces will be damaged or marred. Keep moving parts clean, dry and lubricated.

P. Cleaning Up:

1. Upon completion of the work and at various time during the progress of the work, remove from the building all surplus materials, rubbish and debris resulting from the work of this Division.

2. Thoroughly clean switchgear including busses, apparatus, exposed conduit, metal work including the exterior and interior, and accessories for the work of this Division, of cement, plaster and other deleterious materials; remove grease and oil spots with cleaning solvent; carefully wipe surfaces and scrape cracks and corners clean.

3. Thoroughly polish chromium or plated work. Remove dirt and stains from lighting fixtures.

4. Leave the entire installation in a clean condition.

Q. Completion:

1. The work will not be reviewed for final acceptance until operating and maintenance data, manufacturer's literature, panel directories and nameplates specified herein have been approved and properly posted or installed and final cleaning of equipment and premises has been completed.
2. When the installation is complete and adjustments have been made, operate the system for a period of one week, during which time demonstrate that systems are completed and operating in conformance with the specifications.

R. Operating and Maintenance Data: Submit complete and at one time, prior to acceptance of the installation, 4 copies of manufacturer's instructions for operation and maintenance of electrical equipment, including replacement parts lists. As specified in Division 01

S. Inspection and Acceptance Procedures: The Architect will submit observation reports periodically during the construction phase detailing Contract deficiencies. The Contractor is responsible for making corrections immediately. Notice of Completion of the project will not be made until all items have been corrected.

T. Final Completion of Electrical Systems:

1. Prior to Final Completion of operating electrical systems, the Contractor shall:
    i. Provide materials of the type and quality specified and as necessary for proper operation, tested and ready for use.
    ii. Furnish the required Operating and Maintenance Data/Manuals.
    iii. Clean up of the project pertaining to this Division of the work.
    iv. After installation has been completed and adjustments made, operate the system for a period of one week, during which time, demonstrate to the Architect that systems are complete and operating in conformance with Contract Documents.
    v. Conduct tests required and as specified in this Division and submit test reports and corrective actions taken.
    vi. Submission of warranties and guarantees.
2. Final Completion of Work Shall be Contingent On:
    i. Contractor replacing defective materials and workmanship.
    ii. Upon completion of work and adjustments made, Contractor shall conduct an operating test for each system for approval at such time as Architect directs. Conduct test in presence of authorized representative of Architect and demonstrate that systems and equipment do operate in accordance with requirements of the Contract Documents and are free from electrical and mechanical defects.
    iii. Contractor shall provide the necessary training programs and instructions to the Owner's representative. Number of hours shall be a minimum of four (4) hours for each system or days as required under separate Sections of these Specifications. Complete operation and maintenance manuals shall be provided at least two (2) weeks prior to training.
    iv. Submit copies of manufacturer's instructions and maintenance of electrical equipment including replacement parts lists. Each set shall include one set of shop drawings of equipment installed.

U. Submittals for Change Orders: When changes are made during the construction phase, deletions and additions shall be presented in a manner that will indicate the cost of each item of material and corresponding labor. Markup shall be then added in accordance with the requirements of the General Conditions as modified by the Supplementary Conditions.

V. The Contractor at a time convenient to the Owner shall provide instruction to the Owner's operating personnel in the proper operation and maintenance of all equipment and systems. The instructors shall have received factory training and shall be thoroughly familiar with the equipment installed. The operating personnel shall receive the number of days instruction as indicated in other sections.

1.03 PROJECT RECORD DOCUMENTS

A. Record Drawings: CAD: Use a computer aided drafting (CAD) system in the preparation of record drawings for this Project. Acceptable CAD systems shall be capable of producing files in AutoCAD Version 2004 compatible DWG or DXF format. Owner's consultant will furnish CAD backgrounds for use by the Contractor after construction is 85% complete except where prohibited by Contract.

B. Record Set During the Work: At site, maintain at least one set of Drawings as a Field Record Set. Also maintain at least one copy of all Addenda, Modifications, approved submittals, correspondence, and transmittals at site. Keep Drawings and data in good order and readily available to Architect and Owner.

C. Changes: Clearly and correctly mark Record Drawings to show changes made during the construction process at the time the changed work is installed. No such changes shall be made in the work unless authorized by the Architect.

D. Final Record Drawings: Conform to Division 01 requirements.

E. Preparation of Final Record Drawings: Contractor shall transfer recorded changes in the work indicated on the Field Record Set to the record set. Changes shall be neatly and clearly drawn and noted by skilled draftsmen, and shown technically correct.

F. Approval: Prior to Architect's inspection for Substantial Completion, submit the Final Record Drawings to the Architect for review, and make such revisions as may be necessary for Final Record Drawings to be a true, complete, and accurate record of the work.

G. Manuals: Obtain data from the various manufacturers and submit instruction, operation, and maintenance manuals as required and to the extent required under other Sections.

H. At all times when the work is in progress, maintain at the workplace, fabrication shop or Project Site as applies, a complete separate, clean, undamaged set of the latest stamped, actioned submittals. As work progresses, maintain records of "as installed" conditions on this set in suitable ink or chemical fluid. Update the set daily. After successful completion of Project Site testing specified herein, and after completion of Punch List corrections, copy all records of "as installed" conditions on to originals.

I. Quantity:

1. Review sets:As for Shop and Field Drawings.
2. Record set:Refer to Division 01.

J. Content: All drawings required under "Field and Shop Drawings". Show "as installed" condition. Where room designations according to Project permanent signage differ from construction designations in the Contract Documents, show both designations.

K. Warranty Certificates: Comply with Division 01.

PART 2 - COMMISSIONING

2.01 COMMISSIONING OF ELECTRICAL SYSTEMS

A. Include cost for commissioning requirements in the contract price.

B. Attend commissioning meetings scheduled by the CxA.

C. Prepare preliminary schedule for indoor lighting system inspections, O&M manual submission, training sessions, lighting controls testing, system verification, performance testing, and system completion for use by the CxA. Update schedule as appropriate throughout the construction period and provide updated schedule to the commissioning team.

D. Verify proper installation and performance of all electrical services provided.

E. Complete Title 24 Certificate(s) of Installation and manufacturer's pre-start checklists prior to scheduling startup of HVAC and electrical equipment.

1. Retain Certificate(s) of Installation in a 3-ring binder in an organized fashion. Binder is to remain on the job site
2. Make Certificate(s) of Installation available for CxA review upon request.
3. Retain calibration records for equipment provided with manufacturer calibrated sensors in the Certificate(s) of Installation binder.

F. Where applicable, complete the Certificate(s) of Acceptance per the contract documents.

1. Retain Certificate(s) of Acceptance in a 3-ring binder in an organized fashion. Binder is to remain on the job site
2. Provide copies of all Certificate(s) of Acceptance to the CxA.
3. Certificate(s) of Acceptance shall be conducted by companies who are certified as California Advanced Lighting Controls Training Program Acceptance Technician (CALCTP-AT) employer and only completed by those employees of said company who are certified to complete the respective acceptance test.

G. Monitor and respond to Resolution Tracking Forms distributed by the CxA in order to expedite corrective actions necessary to achieve design intent.

H. Participate in the Certificate(s) of Acceptance and Functional Performance Tests as required to achieve design intent.

I. Participate in the opposite-season testing as required to achieve design intent.

J. Participate in O&M Training as required by project specifications.

K. Ensure participation of major equipment manufacturers and their representatives as applicable.

L. Obtain O&M data on all equipment and assemble in binders using tabs as required.

M. Conduct a maintenance orientation and inspection with hands on training per the contract documents.

N. Provide written certification and completed Certificate(s) of Installation forms and checklists documenting that the following work has been completed in accordance with the plans and specifications and that they are functioning as designed.

1. Correct labeling of all circuits with connected equipment.
2. Lighting system controls operations, including occupancy sensors, automatic time controls or Energy Management control, override timers, manual dimming controls, exterior lighting controls, multi-level switching, as applicable to the Work.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Single conductor building wire.

B. Wiring connectors.

C. Electrical tape.

D. Heat shrink tubing.

E. Wire pulling lubricant.

F. Cable ties.

1.02 RELATED REQUIREMENTS

A. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.

2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.

3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

B. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and

product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Nonmetallic-sheathed cable is not permitted.

D. Underground feeder and branch-circuit cable is not permitted.

E. Service entrance cable is not permitted.

F. Armored cable is not permitted.

G. Metal-clad cable is not permitted.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Provide new conductors and cables manufactured not more than one year prior to installation.

D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

E. Comply with NEMA WC 70.

F. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

G. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

H. Conductor Material:

1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
3. Tinned Copper Conductors: Comply with ASTM B33.

I. Minimum Conductor Size:

1. Branch Circuits: 12 AWG.
    i. Exceptions:
        1. 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
        2. 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
        3. 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
2. Control Circuits: 14 AWG.

J. Conductor Color Coding:

1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
2. Color Coding Method: Integrally colored insulation.
    i. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
3. Color Code:

i. 480Y/277 V, 3 Phase, 4 Wire System:

1. Phase A: Brown.
2. Phase B: Orange.
3. Phase C: Yellow.
4. Neutral/Grounded: Gray.

ii. 208Y/120 V, 3 Phase, 4 Wire System:

1. Phase A: Black.
2. Phase B: Red.
3. Phase C: Blue.
4. Neutral/Grounded: White.

iii. Equipment Ground, All Systems: Green.

2.03 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:

1. Copper Building Wire:

i. Cerro Wire LLC: www.cerrowire.com.
ii. Encore Wire Corporation: www.encorewire.com.
iii. Southwire Company: www.southwire.com.
iv. Rome Wire and Cable.
v. Okonite Wire
vi. Pirelli Wire and Cable
vii. Carol Cable

B. Description: Single conductor insulated wire.

C. Conductor Stranding:

1. Feeders and Branch Circuits:

i. Size 10 AWG and Smaller: Solid.
ii. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:

1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.

i. Size 4 AWG and Larger: Type XHHW-2.
ii. Installed Underground: Type XHHW-2.

2.04 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Wiring Connectors for Splices and Taps:

1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring

connectors.

2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.

C. Wiring Connectors for Terminations:

1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.

2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.

3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.

4. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.

D. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

E. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

F. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.

G. Mechanical Connectors: Provide bolted type or set-screw type.

H. Compression Connectors: Provide circumferential type or hex type crimp configuration.

2.05 WIRING ACCESSORIES

A. Electrical Tape:

1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.

2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.

3. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.

4. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.

5. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.

C. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.

D. Cable Ties: Material and tensile strength rating suitable for application.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

A. Circuiting Requirements:

1. Unless dimensioned, circuit routing indicated is diagrammatic.
2. When circuit destination is indicated without specific routing, determine exact routing required.
3. Arrange circuiting to minimize splices.
4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
5. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
6. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Installation in Raceway:

1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
2. Pull all conductors and cables together into raceway at same time.
3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

E. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

F. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

1. Installation Above Suspended Ceilings: Do not provide support from ceiling support

system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.

2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.

G. Install conductors with a minimum of 12 inches of slack at each outlet.

H. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.

I. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

J. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

K. Make wiring connections using specified wiring connectors.

1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.

2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.

3. Do not remove conductor strands to facilitate insertion into connector.

4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.

5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.

6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

L. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.

1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.

i. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.

2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.

i. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.

ii. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.

3. Wet Locations: Use heat shrink tubing.

M. Insulate ends of spare conductors using vinyl insulating electrical tape.

N. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

O. Identify conductors and cables in accordance with Section 26 05 53.

P. Install firestopping to preserve fire resistance rating of partitions and other elements, using

materials and methods specified in Section Firestopping.

Q. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.04 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.

C. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

1.02 REFERENCE STANDARDS

A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2012.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Verify exact locations of underground metal water service pipe entrances to building.
2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

B. Field quality control test reports.

C. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Do not use products for applications other than as permitted by NFPA 70 and product listing.

B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

D. Grounding System Resistance:

1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.

2. Grounding Electrode System: Not greater than 25 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.

E. Grounding Electrode System:

1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.

i. Provide continuous grounding electrode conductors without splice or joint.

ii. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.

2. Metal Underground Water Pipe(s):

i. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.

ii. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.

iii. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.

3. Metal In-Ground Support Structure:

i. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.

4. Concrete-Encased Electrode:

i. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.

5. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.

F. Bonding and Equipment Grounding:

1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing

electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.

2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.

2.02 2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
   1. Provide products listed, classified, and labeled as suitable for the purpose intended.
   2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 05 26:
   1. Use insulated copper conductors unless otherwise indicated.
      i. Exceptions:
         1. Use bare copper conductors where installed underground in direct contact with earth.
         2. Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:
   1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
   2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
   3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

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

B. Perform work in accordance with NECA 1 (general workmanship).

C. Make grounding and bonding connections using specified connectors.

1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

D. Identify grounding and bonding system components in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.13.

C. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

D. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2015.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.

2. Coordinate the work with other trades to provide additional framing and materials required for installation.

3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.

4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.

5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.

B. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

1.06 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:

1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.

2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.

3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 5 times the applied force. Include consideration for vibration, equipment operation, and shock loads where applicable.

4. Do not use products for applications other than as permitted by NFPA 70 and product listing.

5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.

6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.

i. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.

b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.

c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.

d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.

1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.

2. Conduit Clamps: Bolted type unless otherwise indicated.

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.

1. Comply with MFMA-4.

2. Channel Material:

i. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.

ii. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

F. Anchors and Fasteners:

1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
2. New Concrete: Use preset concrete inserts.
3. Existing Concrete: Use expansion anchors.
4. Solid or Grout-Filled Masonry: Use expansion anchors.
5. Hollow Masonry: Use toggle bolts.
6. Hollow Stud Walls: Use toggle bolts.
7. Steel: Use welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts or Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
8. Wood: Fasten with lag screws or through bolts.
9. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
10. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    i. Comply with MFMA-4.
    ii. Channel Material: Use galvanized steel.
    iii. Manufacturer: Same as manufacturer of metal channel (strut) framing system.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

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

B. Perform work in accordance with NECA 1 (general workmanship).

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Equipment Support and Attachment:

1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

I. Secure fasteners according to manufacturer's recommended torque settings.

J. Remove temporary supports.

3.03 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete or Cast-in-Place Concrete (Limited Applications)" as applicable.

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturers written instructions.

3.04 FIELD QUALITY CONTROL

A. Inspect support and attachment components for damage and defects.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 26 05 33.13

CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. PVC-coated galvanized steel rigid metal conduit (RMC).

C. Flexible metal conduit (FMC).

D. Liquidtight flexible metal conduit (LFMC).

E. Electrical metallic tubing (EMT).

F. Rigid polyvinyl chloride (PVC) conduit.

G. Conduit fittings.

H. Accessories.

1.02 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2015.

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2015.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

D. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2013.

E. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2003.

F. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

G. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit; 2005 (R2013).

H. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2013.

I. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2015.

J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

L. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

M. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.

N. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

O. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

P. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate minimum sizes of conduits with the actual conductors to be installed,

including adjustments for conductor sizes increased for voltage drop.

2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

B. Project Record Documents: Record actual routing for conduits installed underground and conduits 2 inch (53 mm) trade size and larger.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:

1. Under Slab on Grade: Use rigid PVC conduit.
2. Exterior, Direct-Buried: Use rigid PVC conduit.
3. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
4. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use PVC-coated galvanized steel rigid metal conduit elbows for bends.
5. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape to provide supplementary corrosion protection or use PVC-coated galvanized steel rigid metal conduit.

6. Where steel conduit emerges from concrete into soil, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches on either side of where conduit emerges or use PVC-coated galvanized steel rigid metal conduit.

D. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).

E. Concealed Within Hollow Stud Walls: Use electrical metallic tubing (EMT).

F. Concealed Above Accessible Ceilings: Use electrical metallic tubing (EMT).

G. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit.

H. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).

I. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit.

1. Locations subject to physical damage include, but are not limited to:

i. Where exposed below 8 feet, except within electrical and communication rooms or closets.

J. Exposed, Exterior: Use galvanized steel rigid metal conduit.

K. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit.

L. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.

1. Maximum Length: 6 feet.

M. Connections to Vibrating Equipment:

1. Dry Locations: Use flexible metal conduit.
2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
3. Maximum Length: 6 feet unless otherwise indicated.
4. Vibrating equipment includes, but is not limited to:

i. Transformers.

ii. Motors.

N. Fished in Existing Walls, Where Necessary: Use flexible metal conduit.

2.02 CONDUIT REQUIREMENTS

A. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Minimum Conduit Size, Unless Otherwise Indicated:

1. Branch Circuits: 3/4 inch (21 mm) trade size.
2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
3. Control Circuits: 1/2 inch (16 mm) trade size.
4. Flexible Connections to Luminaires: 3/8 inch (12 mm) trade size.
5. Underground, Exterior: 1 inch (27 mm) trade size.

D. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

B. Fittings:

1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

2. Material: Use steel or malleable iron.

3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.

B. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil.

C. PVC-Coated Fittings:

1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.

2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.

3. Material: Use steel or malleable iron.

4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil.

D. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil.

2.05 FLEXIBLE METAL CONDUIT (FMC)

A. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

B. Fittings:

1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

2. Material: Use steel or malleable iron.

2.06 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

B. Fittings:

1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

2. Material: Use steel or malleable iron.

2.07 ELECTRICAL METALLIC TUBING (EMT)

A. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

B. Fittings:

1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

2. Material: Use steel or malleable iron.
3. Connectors and Couplings: Use compression (gland) or set-screw type.
    i. Do not use indenter type connectors and couplings.

2.08 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

B. Fittings:
    1. Manufacturer: Same as manufacturer of conduit to be connected.
    2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.09 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil.

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.

C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

D. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.

PART 3 - EXECUTION

3.01 INSTALLATION

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

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.

E. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

F. Conduit Routing:
    1. Unless dimensioned, conduit routing indicated is diagrammatic.
    2. When conduit destination is indicated without specific routing, determine exact routing required.
    3. Conceal all conduits unless specifically indicated to be exposed.
    4. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
    5. Arrange conduit to maintain adequate headroom, clearances, and access.
    6. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
    7. Arrange conduit to provide no more than 150 feet between pull points.

8. Route conduits above water and drain piping where possible.
9. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
10. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
11. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
    i. Heaters.
    ii. Hot water piping.
    iii. Flues.
12. Group parallel conduits in the same area together on a common rack.

G. Conduit Support:

1. Secure and support conduits in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
4. Use conduit strap to support single surface-mounted conduit.
    i. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
5. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
7. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
8. Use non-penetrating rooftop supports to support conduits routed across rooftops (only where approved).
9. Use of spring steel conduit clips for support of conduits is not permitted.
10. Use of wire for support of conduits is not permitted.

H. Connections and Terminations:

1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.

6. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
7. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

I. Penetrations:

1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

J. Underground Installation:

1. Minimum Cover, Unless Otherwise Indicated or Required:
    i. Underground, Exterior: 24 inches.
    ii. Under Slab on Grade: 12 inches to bottom of slab.
2. Provide underground warning tape in accordance with Section 26 05 53 along entire conduit length.

K. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Section Concrete with minimum concrete cover of 3 inches on all sides unless otherwise indicated.

L. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:

1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where conduits are subject to earth movement by settlement or frost.

M. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:

1. Where conduits pass from outdoors into conditioned interior spaces.
2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

N. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

O. Provide grounding and bonding in accordance with Section 26 05 26.

P. Identify conduits in accordance with Section 26 05 53.

3.02 FIELD QUALITY CONTROL

A. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

B. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.

C. Correct deficiencies and replace damaged or defective conduits.

3.03 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.04 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

SECTION 26 05 33.16

BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

I. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

J. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for floor boxes and

underground boxes/enclosures.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 - PRODUCTS

2.01 BOXES

A. General Requirements:

1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled as suitable for the purpose intended.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:

1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use suitable concrete type boxes where flush-mounted in concrete.
4. Use suitable masonry type boxes where flush-mounted in masonry walls.
5. Use raised covers suitable for the type of wall construction and device configuration where required.
6. Use shallow boxes where required by the type of wall construction.
7. Do not use "through-wall" boxes designed for access from both sides of wall.
8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes.
12. Minimum Box Size, Unless Otherwise Indicated:
    i. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
    ii. Communications Systems Outlets: 4 inch square by 2-1/8 inch (100 by 54 mm) trade size.
    iii. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.

13. Wall Plates: Comply with Section 26 27 26.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:

1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated:
3. Junction and Pull Boxes Larger Than 100 cubic inches:
    i. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

PART 3 - EXECUTION

3.01 INSTALLATION

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

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G. Box Locations:

1. Locate boxes to be accessible. Provide access panels in accordance with Section Access Panels as required where approved by the Architect.
2. Unless dimensioned, box locations indicated are approximate.
3. Locate boxes as required for devices installed under other sections or by others.

a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 27 26.

4. Locate boxes so that wall plates do not span different building finishes.
5. Locate boxes so that wall plates do not cross masonry joints.
6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.

a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.

b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.

10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 05 33.13.

11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
    i. Concealed above accessible suspended ceilings.
    ii. Within joists in areas with no ceiling.
    iii. Electrical rooms.
    iv. Mechanical equipment rooms.

H. Box Supports:
1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.

I. Install boxes plumb and level.

J. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

K. Install boxes as required to preserve insulation integrity.

L. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

M. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

N. Close unused box openings.

O. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

P. Provide grounding and bonding in accordance with Section 26 05 26.

3.02 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.03 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Voltage markers.

E. Underground warning tape.

F. Warning signs and labels.

1.02 RELATED REQUIREMENTS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

B. Section 26 27 26 - Wiring Devices - Lutron: Device and wallplate finishes; factory pre-marked wallplates.

1.03 REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2011.

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 70E - Standard for Electrical Safety in the Workplace; 2015.

E. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:

1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.

2. Do not install identification products until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

B. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

1.06 1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.07 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 - PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:

1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.

i. Switchboards:

1. Identify ampere rating and name.
2. Identify voltage and phase.
3. Identify power source and circuit number. Include location when not within sight of equipment.
4. Use identification nameplate to identify main overcurrent protective device.
5. Use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.

ii. Panelboards:

1. Identify ampere rating and name.
2. Identify voltage and phase.
3. Identify power source and circuit number. Include location when not within sight of equipment.
4. Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
5. For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.

iii. Transformers:

1. Identify kVA rating and name.

2. Service Equipment:

i. Use identification nameplate to identify each service disconnecting means.

3. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70, including but not limited to the following.

i. Service equipment.
ii. Industrial control panels.
iii. Motor control centers.
iv. Elevator control panels.
v. Industrial machinery.

4. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards

for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.

i. Minimum Size: 3.5 by 5 inches.

ii. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.

B. Identification for Conductors and Cables:

1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.
2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:

i. At each source and load connection.

ii. Within boxes when more than one circuit is present.

iii. Within equipment enclosures when conductors and cables enter or leave the enclosure.

iv. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.

C. Identification for Raceways:

1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet.
2. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.
3. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
4. Use underground warning tape to identify underground raceways.

D. Identification for Boxes:

1. Use voltage markers to identify highest voltage present.
2. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.

i. For exposed boxes in public areas, use only identification labels.

E. Identification for Devices:

1. Wiring Device and Wallplate Finishes: Comply with Section 26 27 26.
2. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.

i. For receptacles in public areas or in areas as directed by Architect, provide

identification on inside surface of wallplate.

3. Use identification label or engraved wallplate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.

F. Identification for Luminaires:

1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:

1. Materials:

i. Indoor Clean, Dry Locations: Use plastic nameplates.

ii. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.

2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.

i. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.

3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.

4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.

5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:

1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.

2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:

1. Minimum Size: 1 inch by 2.5 inches.

2. Legend:

i. Equipment designation or other approved description.

3. Text: All capitalized unless otherwise indicated.

4. Minimum Text Height:

i. Equipment Designation: 1/2 inch.

ii. Other Information: 1/4 inch.

5. Color:

i. Normal Power System: White text on black background.

D. Format for Caution and Warning Messages:

1. Minimum Size: 2 inches by 4 inches.

2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/2 inch.
5. Color: Black text on yellow background unless otherwise indicated.

E. Format for Receptacle Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Power source and circuit number or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

F. Format for Control Device Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Load controlled or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

2.03 WIRE AND CABLE MARKERS

A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

C. Legend: Power source and circuit number or other designation indicated.

D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

E. Minimum Text Height: 1/8 inch.

F. Color: Black text on white background unless otherwise indicated.

2.04 VOLTAGE MARKERS

A. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

B. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

C. Minimum Size:
1. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
2. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
3. Markers for Junction Boxes: 1/2 by 2 1/4 inches.

D. Legend:
1. Markers for Voltage Identification: Highest voltage present.

E. Color: Black text on orange background unless otherwise indicated.

2.05 UNDERGROUND WARNING TAPE

A. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

B. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.

C. Legend: Type of service, continuously repeated over full length of tape.

D. Color:

2.06 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:

1. Materials:
2. Minimum Size: 7 by 10 inches unless otherwise indicated.

C. Warning Labels:

1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 - EXECUTION

3.01 INSTALLATION

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

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:

1. Surface-Mounted Equipment: Enclosure front.
2. Flush-Mounted Equipment: Inside of equipment door.
3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
4. Elevated Equipment: Legible from the floor or working platform.
5. Branch Devices: Adjacent to device.
6. Interior Components: Legible from the point of access.
7. Conduits: Legible from the floor.
8. Boxes: Outside face of cover.
9. Conductors and Cables: Legible from the point of access.
10. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.

G. Mark all handwritten text, where permitted, to be neat and legible.

3.02 FIELD QUALITY CONTROL

A. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

SECTION 26 08 01

COMMISSIONING OF ELECTRICAL SYSTEMS

INTRODUCTION

1.01 THE ARCHITECT/OWNER DIRECTLY CONTRACTS A COMMISSIONING AGENT FOR THIS PROJECT. THIS SPECIFICATION DETAILS THE ROLES AND RESPONSIBILITIES OF EACH PROJECT TEAM MEMBER AS THEY APPLY TO COMMISSIONING. EACH CONTRACTOR SHOULD REVIEW THIS PROCEDURE AND INCLUDE ADEQUATE TIME IN THEIR PROPOSAL.

1.02 RELATED DOCUMENTS

A. Contract drawings and specifications, general provisions of the contract, including general and supplementary conditions, electrical provisions and Division-1 Specification sections apply to work of this section.

1.03 DESCRIPTION OF WORK

A. The purpose of the commissioning process is to provide the owner/operator of the facility with a high level of assurance that the electrical systems have been installed in the prescribed manner, and operate within the performance guidelines set in the Design Intent Documents (DID). The CxA shall provide the owner with an objective view of the system's design, installation, operation, and performance. This process is not intended to take away or reduce the responsibility of the design team or installing contractors to provide a finished product. Commissioning is intended to enhance the quality of system start-up and aid in the orderly transfer of systems for beneficial use by the owner. The CxA will be a member of both the design and construction team. During the design phase, the CxA will assist the owner in development of the Owner's Project Requirements, review the Basis of Design, produce a design phase commissioning process plan, and develop project-specific commissioning specifications. During the construction phase, the CxA will administer and coordinate commissioning activities with the design team, construction manager, subcontractors, manufacturers and equipment suppliers which will include commissioning coordination meetings, equipment installation inspections, functional performance testing, issues resolution, and documentation of all aforementioned tasks and activities.

1.04 REFERENCES

A. ASHRAE Guideline 0 - 2013

B. ASHRAE Guideline 1-2007

C. ACG Commissioning Guideline – 2005

1.05 ROLES AND RESPONSIBILITIES OF THE COMMISSIONING AGENCY

A. Mission: The primary point of responsibility is to inform the general contractor, the owner and design team on the status, integration, and performance of mechanical and electrical systems within the facility.

B. Information: The CxA shall function as a catalyst and initiator to disseminate information and assist the design and construction teams in implementing completion of the construction process. This shall include system verification, functional performance testing, and conformance with the intended design of each system. Services include documenting construction observations, verification and functional performance testing, and documenting proper distribution of performance and operating information to the owners O&M staff.

C. Quality Assurance: Assist the responsible parties to maintain a high quality level of installation by meeting or exceeding prevailing standards and specifications.

D. Observation of Tests: The CxA shall observe and coordinate testing as required to assure

system performance meets the design intent.

E. Documentation of Tests: The CxA shall document the results of the performance testing directly and/or assure that the appropriate technicians document testing. The CxA shall compile standard forms, in addition to the Certificate(s) of Installation and Certificate(s) of Acceptance required by Title 24, to be used by the commissioning team for consistency of approach and type of information to be recorded.

F. Deficiencies: The CxA shall provide technical expertise to facilitate and verify the correction of deficiencies found during the commissioning process.

G. Resolution of Deficiencies: The CxA shall investigate the scope and extent of problems and facilitate communication to determine responsibilities by delineating specifications. The CxA shall monitor resolution for conformance with design intent and prevailing industry standards.

H. Acceptance: The CxA shall document the date of acceptance as determined by the General Contractor, owner and design team.

I. Certificate(s) of Installation, Certificate(s) of Acceptance and Functional Performance Test results may be used in determining the start of the warranty period for HVAC and lighting systems and subsystems.

J. O&M Material: The CxA will review operation and maintenance materials for HVAC systems, indoor lighting systems, water heating systems and covered processes.

1.06 ROLES AND RESPONSIBILITIES OF THE OWNER

A. Assign facilities personnel and schedule them to participate in the various meetings, training sessions and inspections as follows:

1. It is in the Owner's best interest to have facilities staff attend the following meetings:

i. Owners training session(s).

ii. Contractors' commissioning kick-off meeting

1. At the kickoff meeting, the Owner will indicate to GC whether facilities staff will attend any of the meetings detailed below.

2. It is at the Owner's discretion to have facilities staff attend the following Cx meetings:

i. Equipment start-up events.

ii. Lighting controls testing and acceptance

iii. Functional performance testing of lighting control systems.

1.07 ROLES AND RESPONSIBILITIES OF THE DESIGN TEAM

A. Provide Basis of Design Narrative.

B. Verify adequate maintenance accessibility for each piece of equipment in shop drawings and actual installation. Visit site periodically and inspect construction.

1.08 ELECTRICAL SYSTEMS INCLUDED IN THE COMMISSIONING PROCESS

A. Lighting Control Panels

B. Occupancy Sensors and Photocells

C. Demand Response

1.09 HVAC AND ELECTRICAL COMMISSIONING PLAN

A. Commissioning Team

1. The Commissioning Team (CT) shall consist of key parties involved in design, construction and testing of this facility. It is necessary for each agency to appoint

team members that will have long-term commitments to this project. Switching team members during the project will reduce the ability of the CT to provide continuity and acceptable results to the building owner. Team members must maintain an ongoing supervisory position on this project. One team member shall be provided by each of the parties listed below:

i. Program Manager/Owner (PrM)

ii. Commissioning Agent (CxA)

iii. Design Team (DT)

iv. General Contractor (GC)

v. Electrical Contractor (EC)

B. Design Intent Document

1. The Design Intent Document (DID) represents a composite of design drawings, project specifications, submittals, change orders and industry standards, prepared by the designer of record, that describe the systems of this facility. References to design intent will be taken from the DID. The DID is an evolving manuscript maintained by the design professional to track and incorporate design alterations that occur throughout the construction process. Any industry standards used for this project will be specifically noted when referenced.

2. The CxA will review the DID documents for commissioning provisions, functional performance, optimization of performance, accessibility, and O&M considerations.

C. Commissioning Meetings

1. Commissioning meetings will be held in conjunction with progress meetings when possible and as necessary.

2. Commissioning meetings will be used to address any problems that alter the design intent or affect the commissioning process. These meetings provide an open forum for exchange of ideas between contractors, vendors, designers, users and owners.

D. Resolution Tracking Forms (RTF)

1. The use of Resolution Tracking Forms is a method employed by the CxA to monitor and record problems, their causes, and solutions. The use of these lists promotes communication between the installing contractors, design team, commissioning agent, and owner, in order to expedite their resolution in a timely manner.

2. The CxA will regularly submit RTF's to the CT in order to document and resolve deficiencies as quickly as possible. The frequency of RTF submission will be adjusted as project conditions dictate.

E. Certificate(s) of Installation/ Manufacturer's Checklists

1. If requested, copies of the Certificate(s) of Installation shall be provided to the CxA within 7 days of request.

2. If requested, copies of the manufacturer's startup forms shall be provided to the CxA within 7 days of request.

F. Start-Up

1. The CxA will witness start-up of major systems when applicable. The systems to be witnessed will be identified and discussed during the Cx construction kickoff meeting. The appropriate contractors and/or manufacturer's representative will be required on site to perform start-up.

2. The installing contractor shall notify the CxA no later than 7 days prior to startup of

equipment.

G. Functional Performance Tests (FPT)

1. The CxA will write FPT's based on the design intent document. These tests will be created for systems and subsystems.
2. Each major system will be tested. A random sample of each subsystem will be tested. This will be coordinated and witnessed by the CxA.
3. No FPT's will be performed until the system and related subsystems have been started, and the completion of the control system has been documented through point-to-point checklists and other documentation.
4. The Functional Performance Tests shall include lighting control systems. The CxA will make every effort to not have contractors repeat work. However, some of the Functional Performance Tests may repeat the required Certificate(s) of Acceptance forms. For example, if multiple lighting control panels are installed, the CxA will review all of the Acceptance forms and request the contractor responsible for completing the Certificate of Acceptance form repeat one or more unit's lighting control panel tests.
    i. Control systems will be tested as necessary to achieve DID conformance.
    ii. EC will demonstrate to the CxA: luminaire/lamp combinations by inspection, operational tests for lighting control/dimming systems, illumination level measurements in up to 20% of the building area, and interior lighting control performance, including operation of occupancy sensors, automatic time controls, energy management control override timers, manual dimming control, multi-level switching, and other specified lighting controls.
    iii. Conditions of test
    iv. The acceptance of each piece of equipment shall be based on the successful completion of both the Certificate(s) of Acceptance and the CxA's Functional Performance Test.
        1. Each major system will be subject to functional performance testing.
        2. Each subsystem will be subject to sampling of up to 10% of the subsystem equipment.
        3. Examples of the CxA's FPTs are provided below so that the contractor can understand the format and rigor of these tests. These are provided for reference only and should not be used for this projects FPT's. Project-specific FPT's will be provided to the commissioning team by the CxA no later than 3 weeks prior to the beginning of functional performance testing.
        4. The required Certificate(s) of Acceptance are identified on the contract documents. Examples of Certificate(s) of Acceptance can be found on the California Energy Commission website. Contractors should review these documents to understand any and all impacts to their respective scope.

H. Building Turn-Over / Owner Orientation / User Training

1. The CxA may review O&M manuals, to ensure specificity and completeness.
2. The CxA will review as-built drawings, to ensure specificity and completeness.
3. The installing contractor or manufacturer's representative will provide the training. This training should include both classroom training and hands-on operational training. The owner may choose to videotape this training for future use.

4. The CxA will assist in the coordination of off-season testing, calibrating, and servicing as specified in the contract documents.

I. Training of Owner's Operators

1. The Owner's facility staff shall be given comprehensive training in the understanding of the systems and the operation and maintenance of each major piece of equipment.
2. The GC will be responsible for scheduling the training which shall start with classroom sessions followed by hands on training on each piece of equipment. Hands on training shall include start-up, operation in all modes possible, shut-down and any emergency procedures.
3. The EC and/or the manufacturer's representative shall provide the instructions on each major piece of equipment. These sessions shall review safe and proper operating requirements and preventative maintenance.
4. Each classroom training session shall be followed by an inspection, explanation and demonstration of the equipment. The start-up and shut-down modes of operation shall be demonstrated.
5. The GC shall attend all sessions and shall add to each session any special information relating to the details of installation of the equipment as it might impact the operation and maintenance.
6. The EC shall conduct the training session on the lighting controls system hardware and software.
7. The CxA shall conduct training of the project's systems manual.

J. Operation and Maintenance (O&M) Manuals

1. General O&M manual requirements are defined in Section 23 08 01.
2. The EC shall provide for inclusion in the O&M manual the following content:
    i. Design parameters.
        1. Electrical specifications
        2. As-built wiring and control diagrams, with data to explain detailed operation and control of each component.
        3. Control sequences describing start-up, all modes of operation, and shutdown.
        4. Installation instructions
        5. Operating Instructions
        6. Preventative Maintenance Instructions
        7. Maintenance and Overhaul instructions
        8. Corrected shop drawings and submittal data.
        9. Product information identifying all performance curves, rating data, features, and options on all installed equipment
        10. Copies of approved certifications and laboratory test reports.
        11. Copies of warranties.
        12. Test procedures
        13. Parts list

14. Including source of supply and recommended spare parts.
15. Contact Information: Name, address, and 24-hour telephone number of each subcontractor who installed equipment and systems and local representative for each type of equipment for each system.
16. Final approval of the O&M manual shall be by the Owner.

K. Parts List:

1. Parts lists shall be project-specific and edited to omit reference to items which do not apply to this installation.

L. Equipment Supplier:

1. This section shall include the name, address and telephone number of the manufacturer's agent and/or service agency supplying or installing and starting up of the equipment.

M. Controls Description:

1. This will be included in each section covering controlled equipment. It will include the description from the approved lighting control submission, complete with schematic diagram showing piping arrangement and control location on 8-1/2” x 11” or 11” x 17” sheet. This data shall be provided by the EC in a form suitable for insertion into the O&M Manuals.

N. Submittal Requirement:

1. The O&M manuals for each piece of equipment shall be submitted to the GC at the equipment placement completion stage, which shall be defined as that time in the project when the piece of equipment have been set in place ready for connection to power.

1.10 RESPONSIBILITIES OF INSTALLING CONTRACTORS

A. General Contractor (GC)

1. GC and all other contractor requirements for commissioning are included in section 23 08 01. The GC shall ensure that the EC meets the requirements listed in 23 08 01 and the requirements listed in (B.) below.

B. Electrical Contractor (EC)

1. Include cost for commissioning requirements in the contract price.
2. Attend commissioning meetings scheduled by the CxA.
3. Prepare preliminary schedule for indoor lighting system inspections, O&M manual submission, training sessions, lighting controls testing, system verification, performance testing, and system completion for use by the CxA. Update schedule as appropriate throughout the construction period and provide updated schedule to the commissioning team.
4. Verify proper installation and performance of all electrical services provided.
5. Complete Title 24 Certificate(s) of Installation and manufacturer’s pre-start checklists prior to scheduling startup/programming of lighting control equipment.
    i. Retain Certificate(s) of Installation in a 3-ring binder in an organized fashion. Binder is to remain on the job site
    ii. Make Certificate(s) of Installation available for CxA review upon request.
    iii. Retain calibration records for equipment provided with manufacturer calibrated sensors in the Certificate(s) of Installation binder.

iv. Correct labeling of all circuits with connected equipment.

v. Where applicable, complete the Certificate(s) of Acceptance per the contract documents.

    1. Retain Certificate(s) of Acceptance in a 3-ring binder in an organized fashion. Binder is to remain on the job site

    2. Provide copies of all Certificate(s) of Acceptance to the CxA.

    3. Certificate(s) of Acceptance shall be conducted by companies who are certified as California Advanced Lighting Controls Training Program Acceptance Technician (CALCTP-AT) employer and only completed by those employees of said company who are certified to complete the respective acceptance test.

vi. Monitor and respond to Resolution Tracking Forms distributed by the CxA in order to expedite corrective actions necessary to achieve design intent.

vii. Participate in the Certificate(s) of Acceptance and Functional Performance Tests as required to achieve design intent.

viii. Participate in O&M Training as required by project specifications.

ix. Ensure participation of major equipment manufacturers and their representatives as applicable.

x. Obtain O & M data on all equipment and assemble in binders using tabs as required.

xi. Conduct a maintenance orientation and inspection with hands on training per the contract documents.

END OF SECTION

SECTION 26 08 02

INSTALLATION & ACCEPTANCE TESTING OF ELECTRICAL SYSTEMS

INTRODUCTION

1.01 TITLE 24 REQUIRES THE COMPLETION OF ALL APPLICABLE CERTIFICATES OF INSTALLATION AND CERTIFICATES OF ACCEPTANCE FOR LIGHTING SYSTEMS. THIS SHALL INCLUDE INDOOR AND OUTDOOR LIGHTING SYSTEMS.

1.02 RELATED DOCUMENTS

A. Contract drawings and specifications, general provisions of the contract, including general and supplementary conditions, electrical provisions and Division-1 Specification sections apply to work of this section.

1.03 DESCRIPTION OF WORK

A. Complete all Title 24 required Certificate(s) of Installation (NRCI) and Certificate(s) of Acceptance (NRCA) to be completed per the contract documents.

1.04 RESPONSIBILITIES OF INSTALLING CONTRACTORS

A. General Contractor (GC)

1. Ensure that all contractors identified as the contractor responsible for acceptance testing and completion of the Title 24 Certificate(s) of Acceptance are certified by the State of California or its designated body to conduct each respective test.

B. Electrical Contractor (EC)

1. Verify proper installation and performance of all electrical services provided.
2. Complete Title 24 Certificate(s) of Installation and manufacturer's pre-start checklists prior to scheduling startup/programming of lighting control equipment.
    i. Retain Certificate(s) of Installation in a 3-ring binder in an organized fashion. Binder is to remain on the job site
    ii. Make Certificate(s) of Installation available for building inspector's review.
    iii. Retain calibration records for equipment provided with manufacturer calibrated sensors in the Certificate(s) of Installation binder.
    iv. Correct labeling of all circuits with connected equipment.
3. Complete the Certificate(s) of Acceptance per the contract documents.
    i. The company installing the lighting systems must be an authorized Lighting Controls Acceptance Test Employer certified by a Lighting Controls Acceptance Test Technician Certification Provider or include in their bid the cost of retaining and overseeing a contractor who is an authorized Lighting Controls Acceptance Test Employer to complete the acceptance testing.
    ii. All required acceptance testing must be completed by a Lighting Controls Acceptance Test Technician employed by the Lighting Controls Acceptance Test Employer.
    iii. Retain Certificate(s) of Acceptance in a 3-ring binder in an organized fashion. Binder is to remain on the job site
    iv. Upload all Certificate(s) of Acceptance to the California Title 24 Certificates of Acceptance database, if, at the time of project completion, the database is available to the public.

4. Successful completion of the required Acceptance Tests is the responsibility of the installing contractor. Any costs associated with modifications necessary to obtain compliance and re-testing of systems shall be included in the base bid of this project.

END OF SECTION

SECTION 26 09 23

LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Occupancy sensors.

B. Daylighting controls.

1.02 RELATED REQUIREMENTS

A. Section 26 05 29 - Hangers and Supports for Electrical Systems.

B. Section 26 05 33.16 - Boxes for Electrical Systems.

C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 27 26 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, and fan speed controllers.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.

2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.

3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.

4. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.

5. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.04 SUBMITTALS

A. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.

B. Shop Drawings:

1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.

2. Daylighting Controls: Provide lighting plan indicating location, model number, and orientation of each photo sensor and associated system component.

C. Field Quality Control Reports.

D. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Operation and Maintenance Data: Include detailed information on device programming and setup.

F. Project Record Documents: Record actual installed locations and settings for lighting control

devices.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.07 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.08 WARRANTY

A. Provide five year manufacturer warranty for all occupancy sensors.

B. Provide five year manufacturer warranty for all daylighting controls.

PART 2 - PRODUCTS

2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

2.02 OCCUPANCY SENSORS

A. All Occupancy Sensors:

1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.

2. Sensor Technology:

i. Passive Infrared (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.

ii. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.

iii. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.

3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.

4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.

5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.

6. Passive Infrared Lens Field of View: Field customizable by addition of factory masking

material, adjustment of integral blinders, or similar means to block motion detection in selected areas.

7. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
8. Sensitivity: Field adjustable.
9. Adaptive Technology: Field selectable; capable of self-adjusting sensitivity and time delay according to conditions.
10. Integral Photocell: For field selectable and adjustable inhibition of automatic turn-on of load when ambient lighting is above the selected level.
11. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
12. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on the drawings.

B. Wall Switch Occupancy Sensors:

1. All Wall Switch Occupancy Sensors:
    i. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
    ii. Unless otherwise indicated or required to control the load indicated on the drawings, provide line voltage units with self-contained relay.
    iii. Where indicated, provide two-circuit units for control of two separate lighting loads, with separate manual controls and separately programmable operation for each load.
    iv. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
    v. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.

C. Wall Dimmer Occupancy Sensors:

1. General Requirements:
    i. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated dimming control capability , and no leakage current to load in off mode.
    ii. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
    iii. Manual-Off Override Control Capability: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
    iv. Dimmer: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, and listed as complying with UL 1472; type and rating suitable for load controlled.
    v. Finish: Color to be selected.

D. Ceiling Mounted Occupancy Sensors:

1. All Ceiling Mounted Occupancy Sensors:

i. Description: Low profile occupancy sensors designed for ceiling installation.

ii. Unless otherwise indicated or required to control the load indicated on the drawings, provide low voltage units, for use with separate compatible accessory power packs.

iii. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.

iv. Finish: White unless otherwise indicated.

2. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:

i. Standard Range Sensors: Capable of detecting motion within an area of 1000 at a mounting height of 9 feet, with a field of view of 360 degrees.

E. Power Packs for Low Voltage Occupancy Sensors:

1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.

2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on the drawings.

3. Input Supply Voltage: Dual rated for 120/277 V ac.

4. Load Rating: As required to control the load indicated on the drawings.

2.03 DAYLIGHTING CONTROLS

A. System Description: Control system consisting of photo sensors and compatible control modules and power packs, contactors, or relays as required for automatic control of load indicated according to available natural light; capable of integrating with occupancy sensors and manual override controls.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of lighting control devices provided under this section.

1. Mounting Heights: Unless otherwise indicated, as follows:

i. Wall Switch Occupancy Sensors: 48 inches above finished floor.

2. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.

3. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.

C. Install lighting control devices in accordance with manufacturer's instructions.

D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

E. Install lighting control devices plumb and level, and held securely in place.

F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 27 26.

G. Provide required supports in accordance with Section 26 05 29.

H. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

I. Identify lighting control devices in accordance with Section 26 05 53.

J. Occupancy Sensor Locations:

1. Location Adjustments: Within the design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage.

2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

K. Daylighting Control Photo Sensor Locations:

1. Unless otherwise indicated, locate photo sensors for closed loop systems to accurately measure the light level controlled at the designated task location, while minimizing the measured amount of direct light from natural or artificial sources such as windows or pendant luminaires.

2. Unless otherwise indicated, locate photo sensors for open loop systems to accurately measure the level of daylight coming into the space, while minimizing the measured amount of lighting from artificial sources.

L. Lamp Burn-In: Operate lamps at full output for minimum of 100 hours or prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

M. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near the sensor location.

N. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.

O. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.

3.04 FIELD QUALITY CONTROL

A. Inspect each lighting control device for damage and defects.

B. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.

C. Test daylighting controls to verify proper operation, including light level measurements and time delays where applicable. Record test results in written report to be included with submittals.

D. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.

C. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.

D. Adjust daylighting controls under optimum lighting conditions after all room finishes, furniture, and window treatments have been installed to achieve desired operation as indicated or as directed by Architect. Record settings in written report to be included with submittals. Readjust controls calibrated prior to installation of final room finishes, furniture, and window treatments that do not function properly as determined by Architect.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of lighting control devices to Architect, and correct deficiencies or make adjustments as directed.

B. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours of training.
3. Instructor: Qualified contractor familiar with the project and with sufficient knowledge of the installed lighting control devices.
4. Location: At project site.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; Revision E with Supplement 1, 2013.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2015.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

E. NEMA PB 1 - Panelboards; 2011.

F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; 2013.

G. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

K. UL 67 - Panelboards; Current Edition, Including All Revisions.

L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.

4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

C. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

D. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Panelboard Keys: Two of each different key.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation: www.eaton.com.

B. Schneider Electric; Square D Products: www.schneider-electric.us.

C. Siemens Industry, Inc: www.usa.siemens.com.

D. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:

1. Altitude: Less than 6,600 feet.

2. Ambient Temperature:

i. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

C. Short Circuit Current Rating:

1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

F. Bussing: Sized in accordance with UL 67 temperature rise requirements.

1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.

2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

G. Conductor Terminations: Suitable for use with the conductors to be installed.

H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

ii. Indoor Clean, Dry Locations: Type 1.

iii. Outdoor Locations: Type 3R.

2. Boxes: Galvanized steel unless otherwise indicated.

i. Provide wiring gutters sized to accommodate the conductors to be installed.

3. Fronts:

i. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.

ii. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.

4. Lockable Doors: All locks keyed alike unless otherwise indicated.

I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

J. Load centers are not acceptable.

2.03 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:

1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

2. Main and Neutral Lug Type: Mechanical.

C. Bussing:

1. Phase and Neutral Bus Material: Copper.
2. Ground Bus Material: Copper.

D. Circuit Breakers:

1. Provide bolt-on type.
2. Provide thermal magnetic circuit breakers for circuit breaker frame sizes less than 225 amperes.
3. Provide electronic trip circuit breakers for circuit breaker frame sizes 225 amperes and above.

E. Enclosures:

1. Provide surface-mounted or flush-mounted enclosures as indicated.
2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide clear plastic circuit directory holder mounted on inside of door.

2.04 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:

1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
2. Main and Neutral Lug Type: Mechanical.

C. Bussing:

1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
2. Phase and Neutral Bus Material: Copper.
3. Ground Bus Material: Copper.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:

1. Provide surface-mounted or flush-mounted enclosures as indicated.
2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide clear plastic circuit directory holder mounted on inside of door.

2.05 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:

1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the

drawings.

2. Interrupting Capacity:
    i. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
        1. 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
        2. 14,000 rms symmetrical amperes at 480 VAC.
    ii. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
3. Conductor Terminations:
    i. Provide mechanical lugs unless otherwise indicated.
    ii. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
7. Do not use tandem circuit breakers.
8. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required supports in accordance with Section 26 05 29.

F. Install panelboards plumb.

G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

I. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

J. Provide grounding and bonding in accordance with Section 26 05 26.

K. Install all field-installed branch devices, components, and accessories.

L. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.

M. Provide filler plates to cover unused spaces in panelboards.

3.03 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than _____ amperes. Tests listed as optional are not required.

C. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

3.05 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Wall switches.

B. Receptacles.

C. Wall plates.

1.02 RELATED REQUIREMENTS

A. Section 26 05 33.16 - Boxes for Electrical Systems.

B. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; Revision H, 2014.

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); Revision G, 2014.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R2015).

F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2016.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

K. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
5. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:

1. Do not install wiring devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Hubbell Incorporated: www.hubbell-wiring.com.

B. Leviton Manufacturing Company, Inc: www.leviton.com.

C. Lutron Electronics Company, Inc: www.lutron.com.

D. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us

2.02 WIRING DEVICE APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.

D. Provide GFCI protection for receptacles installed within 6 feet of sinks.

E. Provide GFCI protection for receptacles installed in kitchens.

F. Provide GFCI protection for receptacles serving electric drinking fountains.

G. Unless noted otherwise, do not use combination switch/receptacle devices.

2.03 WIRING DEVICE FINISHES

A. Provide wiring device finishes as described below unless otherwise indicated.

B. Wiring Devices, Unless Otherwise Indicated: White with white nylon wall plate.

C. Wiring Devices Installed in Finished Spaces: White with white nylon wall plate.

D. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate.

E. Wiring Devices Installed in Wet or Damp Locations: White with specified weatherproof cover.

2.04 WALL SWITCHES

A. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.

1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

B. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.05 RECEPTACLES

A. Manufacturers:

1. Hubbell Incorporated: www.hubbell-wiring.com.
2. Leviton Manufacturing Company, Inc: www.leviton.com.
3. Lutron Electronics Company, Inc; Designer Style: www.lutron.com/sle.
4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.

1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
2. NEMA configurations specified are according to NEMA WD 6.

C. Convenience Receptacles:

1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
2. Automatically Controlled Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; controlled receptacle marking on device face per NFPA 70; single or duplex as indicated on the drawings.

D. GFCI Receptacles:

1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

2.06 WALL PLATES

A. Manufacturers:

1. Hubbell Incorporated: www.hubbell-wiring.com.
2. Leviton Manufacturing Company, Inc: www.leviton.com.
3. Lutron Electronics Company, Inc: www.lutron.com.
4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us

B. Wall Plates: Comply with UL 514D.

1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
2. Size: Standard.
3. Screws: Metal with slotted heads finished to match wall plate finish.

C. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.

D. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

E. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of wiring devices provided under this section.

1. Mounting Heights: Unless otherwise indicated, as follows:

i. Wall Switches: 48 inches above finished floor.

ii. Receptacles: 18 inches above finished floor or 6 inches above counter.

2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.

3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.

4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.

5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and

tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

I. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.

J. Install wiring devices plumb and level with mounting yoke held rigidly in place.

K. Install wall switches with OFF position down.

L. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

M. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

N. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

O. Identify wiring devices in accordance with Section 26 05 53.

3.04 FIELD QUALITY CONTROL

A. Inspect each wiring device for damage and defects.

B. Operate each wall switch with circuit energized to verify proper operation.

C. Test each receptacle to verify operation and proper polarity.

D. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

E. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 26 28 13

FUSES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Fuses.

1.02 REFERENCE STANDARDS

A. NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.

D. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Bussmann, a division of Eaton Corporation: www.cooperindustries.com.

B. Littelfuse, Inc: www.littelfuse.com.

C. Mersen: ep-us.mersen.com.

2.02 APPLICATIONS

A. Individual Motor Branch Circuits: Class RK1, time-delay.

2.03 FUSES

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C. Provide fuses of the same type, rating, and manufacturer within the same switch.

D. Comply with UL 248-1.

E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.

F. Voltage Rating: Suitable for circuit voltage.

G. Class R Fuses: Comply with UL 248-12.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

B. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION

SECTION 26 28 16.16

ENCLOSED SWITCHES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 28 13 - Fuses.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.

4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

B. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Include dimensioned plan and elevation views of enclosed switches and adjacent

equipment with all required clearances indicated.

C. Project Record Documents: Record actual locations of enclosed switches.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation: www.eaton.com.

B. Schneider Electric; Square D Products: www.schneider-electric.us.

C. Siemens Industry, Inc: www.usa.siemens.com.

D. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:

1. Altitude: Less than 6,600 feet.
2. Ambient Temperature: Between -22 degrees F and 104 degrees F.

D. Horsepower Rating: Suitable for connected load.

E. Voltage Rating: Suitable for circuit voltage.

F. Short Circuit Current Rating:

1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
2. Minimum Ratings:
    i. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.

G. Provide with switch blade contact position that is visible when the cover is open.

H. Fuse Clips for Fusible Switches: As required to accept fuses indicated.

1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

I. Conductor Terminations: Suitable for use with the conductors to be installed.

J. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

K. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

i. Indoor Clean, Dry Locations: Type 1.

ii. Outdoor Locations: Type 3R.

L. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

M. Heavy Duty Switches:

1. Comply with NEMA KS 1.

2. Conductor Terminations:

i. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

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

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required supports in accordance with Section 26 05 29.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 05 26.

H. Provide fuses complying with Section 26 28 13 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

3.03 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

C. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 51 00

INTERIOR LIGHTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Exit signs.

D. Ballasts and drivers.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.

2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.

3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.

4. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.03 SUBMITTALS

A. Shop Drawings:

1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

2. Provide photometric calculations where luminaires are proposed for substitution upon request.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

1. LED Luminaires:

i. Include estimated useful life, calculated based on IES LM-80 test data.

2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IESNA LM-63 standard format upon request.

3. Ballasts: Include wiring diagrams and list of compatible lamp configurations.

4. Lamps: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.

C. Samples:

1. Provide one sample(s) of each luminaire proposed for substitution upon request.

D. Certificates for Dimming Ballasts: Manufacturer's documentation of compatibility with dimming

controls to be installed.

E. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Lenses and Louvers: Two percent of total quantity installed for each type, but not less than one of each type.

2. Extra Lamps: Ten percent of total quantity installed for each type, but not less than two of each type.

3. Extra Ballasts: Two percent of total quantity installed for each type, but not less than one of each type.

G. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.04 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.05 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.06 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.07 WARRANTY

A. Provide five year manufacturer warranty for all LED luminaires, including drivers.

B. Provide five year pro-rata warranty for batteries for emergency lighting units.

PART 2 - PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Recessed Luminaires:

1. Ceiling Compatibility: Comply with NEMA LE 4.
2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.

H. LED Luminaires:

1. Components: UL 8750 recognized or listed as applicable.
2. Tested in accordance with IES LM-79 and IES LM-80.
3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.03 EMERGENCY LIGHTING UNITS

A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

C. Battery:

1. Size battery to supply all connected lamps, including emergency remote heads where indicated.

D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

2.04 EXIT SIGNS

A. Description: Internally illuminated exit signs with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

1. Number of Faces: Single or double as indicated or as required for the installed location.
2. Directional Arrows: As indicated or as required for the installed location.

2.05 BALLASTS AND DRIVERS

A. Ballasts/Drivers - General Requirements:

1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

B. Dimmable LED Drivers:

1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
2. Control Compatibility: Fully compatible with the dimming controls to be installed.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. Suspended Ceiling Mounted Luminaires:

1. Do not use ceiling tiles to bear weight of luminaires.
2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
4. Secure pendant-mounted luminaires to building structure.
5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
6. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

G. Recessed Luminaires:

1. Install trims tight to mounting surface with no visible light leakage.
2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

H. Suspended Luminaires:

1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet between supports.
4. Install canopies tight to mounting surface.

I. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

J. Install accessories furnished with each luminaire.

K. Bond products and metal accessories to branch circuit equipment grounding conductor.

L. Emergency Lighting Units:

1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

M. Exit Signs:

1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

N. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

A. Inspect each product for damage and defects.

B. Operate each luminaire after installation and connection to verify proper operation.

C. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.06 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

B. Just prior to Substantial Completion, replace all lamps that have failed.

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 26 51 20

AUTOMATIC LIGHTING CONTROL SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Provide and design an automatic lighting control system as described in this specification and as called for on the drawings.

1.02 QUALITY ASSURANCE

A. Manufacturer shall have a minimum of 10 years experience in manufacturing and installing this type of system.

B. The Contractor shall provide a list of recent jobs completed during the last 5 years with the name and phone number of a contact person.

C. All components and assemblies are to be pre-tested and assembled at the factory prior to installation.

D. Provide a factory-trained technician on site. The technician shall functionally test each component in the system after installation to verify proper operation and confirm that the panel wiring and addressing conform to the wiring documentation.

1.03 SUBMITTALS

A. The following list includes the required shop drawings and product data information that shall be submitted.

1. Underwriters Laboratories, Inc. (UL) listing and factory test reports.
2. Internal and system wiring diagrams.
3. Single line diagram of the system configuration. Typical riser diagrams are not acceptable.
4. Dimensions of the equipment layout.
5. Control wiring and conduits layout and connections.
6. Floor plans to scale showing the location of each device and equipment.
7. Product data of all the components including but not limited to programmable central controllers, transceivers panels, input relays, switches and other ancillary equipment.

1.04 REFERENCES

A. UL 916 Energy Management Equipment.

B. FCC Emissions Standards specified in Part 15, subpart J for Class A, Applications.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide and microprocessor controlled relay panels for the Lighting Control System. The system shall include programmable standalone master panel, switch inputs, wiring, power supplies, relays and ancillary relays.

B. Panels shall be capable of standing alone or operating as part of a network.

1. The system shall provide intelligence to operate as follows:

i. Store all user operating data.

ii. Initiate all relay output commands based on:

1. Operator inputs
2. Automatic operating schedule
3. Binary type field sensors
4. Universal override switch inputs
5. Internal 56K Baud modem

iii. Provide automatic system diagnostics and alarming based on detected faults in the controller, transceiver panels, relays, and data line.

2. System shall include a memory back up to be able to survive an indefinite length of power failure.

C. Lighting Control Panel (LCP): Microprocessor based, complete prewired assemblies consisting of the following:

1. Stand alone panel controller capable of receiving and acting upon programs downloaded from the central computer. Programs downloaded from the network shall be capable of continuing to operate even if the network should fail. Battery Back up provides 8 days of memory retention. Panel shall be part of a system that can control up to 750 relays and receive up to 500 switch inputs. Panel shall have an USB input for local programming and trouble shooting from a laptop computer.

2. Internal digital clock with self control power.

3. Output modules: Plug in type to receive coded digital commands from the panel controller and pulse output relays to the appropriate state. Actual status feedback of the relays are to be fed back to the panel controller and from there to the central computer. Actual status of each relay is to be indicated by a pilot LED on the control board. Each Module controls 8 or 16 relays.

4. Switch input modules: Plug-in type, actuated by remote external contact closures. These contact closures may be either momentary or maintained. The action of the contact is noted by the panel controller and acted upon as programmed by software. The action of the contact can command any group of output relays to the desired state. Either 8 or 24-input channels as shown on the plans.

5. Output Relays

a. Type: Momentary pulsed, mechanically latched with pilot light contact.

b. Rating: 20 Ampere, 277VAC

c. Number per panel: 16,32 or 48 as required to satisfy this project scope.

6. The low voltage and high voltage sections of the lighting control cabinet shall be separated by a 14 gage steel barrier in which the relays are mounted. In areas where both 120 volt and 277 volt loads are present the high voltage compartment shall have a 14 gage steel barrier between the relays that carry 120 VAC and the relays that carry 277VAC. Each section shall be clearly labeled as to the voltage in that compartment.

7. Panel power supply shall be dual primary 115/277 volts AC, 60 Hz. ± 10%. Low voltage side shall be protected from power line surges and spikes on the input power. The low voltage section shall be protected against short circuit faults and relay failures.

8. Panels shall be UL approved and shall have a short circuit withstand current rating at 14,000 AIC.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The Lighting Control System shall be installed and wired completely as required by the equipment manufacturer by the contractor, who shall make all necessary wiring connections to the lighting fixtures, override switches, photo cells and equipment.

B. The Contractor shall provide on-site programming time with factory-trained personnel for the system set-up. The Contractor shall set up the software program and program the entire system in accordance with the Owner's instructions.

C. Documentation

1. Accurate "as-built" drawings shall be provided by the Contractor. These shall indicate the load controlled by each relay and the identification number for that switch connected to an input and the identification number of that input. Three sets of space plans or reflected ceiling plans shall be provided by the contractor indicating which fixtures are controlled by each relay.

2. A separate data grade private line with RJ45 jack shall be furnished for each modem.

3.02 SERVICE AND SUPPORT

A. Startup: After the system has been installed, the Contractor shall provide the services of a factory trained representative of the manufacturer to verify correct operation of all system components. The contractor shall guarantee all material and workmanship involving the system for three years after startup.

B. Training: After system startup and after all the programming is completed, the Contractor shall arrange for a factory trained representative to train the Owner's personnel. The trainer shall instruct the Owner's personnel in how to program the system and demonstrate a typical operating program for an area. The Contractor shall allow for 24 hours' instruction time for the Owner's training.

C. Factory Support: Factory support shall be available free of charge during the three-year warranty period to answer programming and application questions. The manufacturer, or his representative, shall have a remote terminal capable of programming the system to support the Owner's personnel during this period. The Contractor shall include a modem, necessary cabling and telephone extension to support this telecommunications operation. The Contractor shall provide a three-year maintenance service contract as part of the cost.

D. The Contractor shall also provide a software site licensing so that the Owner will be able to transfer the software program from the main computer to the other computers. This transfer shall not be an extra cost to the Owner.

END OF SECTION

SECTION 27 10 05

STRUCTURED CABLING FOR VOICE AND DATA - INSIDE-PLANT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Communications system design requirements.

B. Communications pathways.

C. Copper cable and terminations.

D. Communications equipment room fittings.

E. Communications outlets.

F. Communications grounding and bonding.

G. Communications identification.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for communications equipment.

2. Coordinate arrangement of communications equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. Shop Drawings: Show compliance with requirements on isometric schematic diagram of network layout, showing cable routings, telecommunication closets, rack and enclosure layouts and locations, service entrance, and grounding, prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).

D. Evidence of qualifications for installer.

E. Field Test Reports.

1.04 QUALITY ASSURANCE

A. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Keep stored products clean and dry.

1.06 WARRANTY

A. Correct defective Work within a 2 year period after Date of Substantial Completion.

PART 2 - PRODUCTS

2.01 SYSTEM DESIGN

A. Provide a complete permanent system of cabling and pathways for voice and data communications, including cables, conduits and wireways, pull wires, support structures, enclosures and cabinets, and outlets.

1. Provide fixed cables and pathways that comply with NFPA 70 and TIA-607-C and are UL listed or third party independent testing laboratory certified.

2. Provide connection devices that are rated for operation under conditions of 32 to 140 degrees F (0 to 60 degrees C) at relative humidity of 0 to 95 percent, noncondensing.

3. In this project, the term plenum is defined as return air spaces above ceilings, inside ducts, under raised floors, and other air-handling spaces.

B. Intermediate Distribution Frames (IDF): Support structures for terminating horizontal cables that extend to telecommunications outlets.

1. Locate intermediate distribution frames in the field.

C. Cabling to Outlets: Specified horizontal cabling, wired in star topology to distribution frame located at center hub of star; also referred to as "links".

2.02 COPPER CABLE AND TERMINATIONS

A. Copper Horizontal Cable:

1. Description: 100 ohm, balanced twisted pair cable complying with TIA-568-C.2 and listed and labeled as complying with UL 444.

2. Cable Type - Voice and Data: TIA-568-C.2 Category 6 UTP (unshielded twisted pair); 23 AWG.

3. Cable Capacity: 4-pair.

4. Cable Applications:

i. Plenum Applications: Use listed NFPA 70 Type CMP plenum cable.

ii. Riser Applications: Use listed NFPA 70 Type CMR riser cable or Type CMP plenum cable.

iii. General Purpose Applications: Use listed NFPA 70 Type CM/CMG general purpose cable, Type CMR riser cable, or Type CMP plenum cable.

5. Cable Jacket Color - Voice and Data Cable: Blue.

B. Copper Cable Terminations: Insulation displacement connection (IDC) type using appropriate tool; use screw connections only where specifically indicated.

C. Jacks and Connectors: Modular RJ-45, non-keyed, terminated with 110-style insulation displacement connectors (IDC); high impact thermoplastic housing; suitable for and complying with same standard as specified horizontal cable; UL 1863 listed.

1. Performance: 500 mating cycles.

2. Voice and Data Jacks: 8-position modular jack, color-coded for both T568A and T568B wiring configurations.

D. Copper Patch Cords:

1. Description: Factory-fabricated 4-pair cable assemblies with 8-position modular connectors terminated at each end.

2.03 COMMUNICATIONS EQUIPMENT ROOM FITTINGS

A. Copper Cross-Connection Equipment:

1. Patch Panels for Copper Cabling: Sized to fit EIA/ECA-310 standard 19 inch (482.6 mm) wide equipment racks; 0.09 inch (2.2 mm) thick aluminum; cabling terminated on Type 110 insulation displacement connectors; printed circuit board interface.

i. Jacks: Non-keyed RJ-45, suitable for and complying with same standard as

cable to be terminated; maximum 48 ports per standard width panel.

ii. Capacity: Provide ports sufficient for cables to be terminated plus 25 percent spare.

iii. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA-606-B.

iv. Provide incoming cable strain relief and routing guides on back of panel.

B. Backboards: Interior grade plywood without voids, 3/4 inch (19 mm) thick; UL-labeled fire-retardant.

1. Do not paint over UL label.

C. Equipment Racks and Cabinets: EIA/ECA-310 standard 19 inch (482.6 mm) wide component racks.

2.04 COMMUNICATIONS OUTLETS

A. Outlet Boxes: Comply with Section 26 0533.16.

1. Provide depth as required to accommodate cable manufacturer's recommended minimum conductor bend radius.

B. Wall Plates:

1. Comply with system design standards and UL 514C.

2. Accepts modular jacks/inserts.

3. Capacity:

4. Wall Plate Material/Finish - Flush-Mounted Outlets: Match wiring device and wall plate finishes specified by Owner.

2.05 GROUNDING AND BONDING COMPONENTS

A. Comply with TIA-607-C.

2.06 IDENTIFICATION PRODUCTS

A. Comply with TIA-606-B.

PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL

A. Comply with Communication Service Provider requirements.

B. Grounding and Bonding: Perform in accordance with TIA-607-C and NFPA 70.

3.02 INSTALLATION OF PATHWAYS

A. Install pathways with the following minimum clearances:

1. 48 inches (1220 mm) from motors, generators, frequency converters, transformers, x-ray equipment, and uninterruptible power systems.

2. 12 inches (300 mm) from power conduits and cables and panelboards.

3. 5 inches (125 mm) from fluorescent and high frequency lighting fixtures.

4. 6 inches (150 mm) from flues, hot water pipes, and steam pipes.

B. Outlet Boxes:

1. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of telecommunications outlets provided under this section.

i. Mounting Heights: Unless otherwise indicated, as follows:

1. Telephone and Data Outlets: 18 inches (450 mm) above finished floor.

3.03 INSTALLATION OF EQUIPMENT AND CABLING

A. Cabling:

1. Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair use bend radius of not less than 4 times cable diameter.
2. Do not over-cinch or crush cables.
3. Do not exceed manufacturer's recommended cable pull tension.
4. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.

B. Service Loops (Slack or Excess Length): Provide the following minimum extra length of cable, looped neatly:

1. At Distribution Frames: 120 inches (3000 mm).
2. At Outlets - Copper: 12 inches (305 mm).

C. Copper Cabling:

1. Category 5e and Above: Maintain cable geometry; do not untwist more than 1/2 inch (12 mm) from point of termination.
2. For 4-pair cables in conduit, do not exceed 25 pounds (110 N) pull tension.
3. Use T568B wiring configuration.

D. Identification:

1. Use wire and cable markers to identify cables at each end.
2. Use manufacturer-furnished label inserts, identification labels, or engraved wallplate to identify each jack at communications outlets with unique identifier.
3. Use identification nameplate to identify cross-connection equipment, equipment racks, and cabinets.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Comply with inspection and testing requirements of specified installation standards.

C. Visual Inspection:

1. Inspect cable jackets for certification markings.
2. Inspect cable terminations for color coded labels of proper type.
3. Inspect outlet plates and patch panels for complete labels.

D. Testing - Copper Cabling and Associated Equipment:

E. Final Testing: After all work is complete, including installation of telecommunications outlets, and telephone dial tone service is active, test each voice jack for dial tone.

END OF SECTION

SECTION 28 10 00

ACCESS CONTROL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Access control system requirements.

B. Access control point peripherals, including readers.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Include plan views indicating locations of system components and proposed size, type, and routing of conduits and/or cables. Include elevations and details of proposed equipment arrangements. Include system interconnection schematic diagrams. Include requirements for interface with other systems.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for each system component. Include ratings, configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.

D. Design Data: Standby battery/UPS calculations.

E. Evidence of qualifications for installer.

F. Evidence of qualifications for maintenance contractor (if different entity from installer).

G. Maintenance contracts.

H. Software: One copy of software not resident in read-only memory.

1.03 QUALITY ASSURANCE

A. Comply with the following:

1. NFPA 70.
2. The requirements of the local authorities having jurisdiction.
3. Applicable TIA/EIA standards.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with access control systems of similar size, type, and complexity and providing contract maintenance service as a regular part of their business; authorized manufacturer's representative.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.05 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.06 WARRANTY

A. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 - PRODUCTS

2.01 ACCESS CONTROL SYSTEM REQUIREMENTS

A. Design and provide new access control system consisting of all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Access Control Points:

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

1. Access Control Units and Readers: Listed and labeled as complying with UL 294.

2.02 ACCESS CONTROL UNITS AND SOFTWARE

A. Provide access control units and associated software compatible with readers to be connected.

2.03 ACCESS CONTROL POINT PERIPHERALS

A. Provide devices compatible with control units.

B. Provide devices suitable for operation under the service conditions at the installed location.

C. Provide readers compatible with credentials to be used.

D. Door Locking Devices (Electric Strikes and Magnetic Locks): Comply with Section 08 7100.

2.04 ACCESSORIES

A. Provide components as indicated or as required for connection of access control system to devices and other systems indicated.

B. Unless otherwise indicated, credentials to be provided by Contractor.

1. Provide credentials compatible with readers and control units/software to be used.

C. Provide cables as indicated or as required for connections between system components.

D. Provide accessory racks/cabinets as indicated or as required for equipment mounting.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings and configurations of system components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive system components.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to system.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install access control system in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Provide grounding and bonding in accordance with Section 26 0526.

D. Identify system wiring and components in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

A. Prepare and start system in accordance with manufacturer's instructions.

B. Program system parameters according to requirements of Owner.

C. Test for proper interface with other systems.

D. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

3.04 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.

B. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

3.06 PROTECTION

A. Protect installed system components from subsequent construction operations.

3.07 MAINTENANCE

A. Provide to Owner, a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of access control system for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

B. Provide trouble call-back service upon notification by Owner:

1. Include allowance for call-back service during normal working hours at no extra cost to Owner.

2. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

END OF SECTION

SECTION 28 20 00

VIDEO SURVEILLANCE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Video surveillance system requirements.

B. Video recording and viewing equipment.

C. Cameras.

D. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 28 1000 - Access Control: For interface with video surveillance system.

E. Section 28 3111 - Building Intrusion Detection: For interface with video surveillance system.

1.03 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices; current edition.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NECA 303 - Standard for Installing Closed-Circuit Television (CCTV) Systems; 2005.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of cameras with structural members, ductwork, piping, equipment, luminaires, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.

2. Coordinate the work with other installers to provide power for cameras and equipment at required locations.

3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Preinstallation Meetings:

1. Conduct meeting with facility representative and other related equipment manufacturers to discuss video surveillance system interface requirements.

1.05 SUBMITTALS

A. Shop Drawings: Include plan views indicating locations of system components and proposed size, type, and routing of conduits and/or cables. Include elevations and details of proposed equipment arrangements. Include system interconnection schematic diagrams. Include requirements for interface with other systems.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each

system component. Include ratings, configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.

C. Design Data:

1. Standby battery/UPS calculations.
2. Video storage capacity calculations.

D. Evidence of qualifications for installer.

E. Evidence of qualifications for maintenance contractor (if different entity from installer).

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

G. Field quality control test reports.

H. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.

I. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

J. Maintenance contracts.

K. Software: One copy of software not resident in read-only memory.

1.06 QUALITY ASSURANCE

A. Comply with the following:

1. NFPA 70.
2. Applicable TIA/EIA standards.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions and NECA 303.

B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Video Recording and Viewing Equipment - New equipment shall be compatible with existing equipment and shall be reviewed by Owner before installation..

2.02 VIDEO SURVEILLANCE SYSTEM

A. Provide new video surveillance system consisting of all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. System Description: IP system with connection to network (IP) cameras.

C. Interface with Other Systems:

1. Provide products compatible with other systems requiring interface with video surveillance system.

2. Interface with access control system as specified in Section 28 1000.

i. Capable of affecting camera/video operation for selected access control system events.

3. Interface with intrusion detection system as specified in Section 28 3111.

D. Provide products listed, classified, and labeled as suitable for the purpose intended.

E. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B, consumer application.

2.03 VIDEO RECORDING AND VIEWING EQUIPMENT

A. Provide video recording and viewing equipment compatible with cameras to be connected.

B. Software:

1. Unless otherwise indicated, provide all software and licenses required for fully operational system.

C. Monitors:

1. Unless otherwise indicated, monitors to be provided by Contractor as part of work of this section.

2.04 CAMERAS

A. Provide mega-pixel cameras and associated accessories suitable for operation under the service conditions at the installed location. Provide additional components (e.g. enclosures, heaters, blowers, etc.) as required.

B. Where not factory-installed, provide additional components (e.g. lenses, mounting accessories, etc.) as necessary for complete installation.

C. Network (IP) Cameras:

1. Signal-to-Noise Ratio: Not less than 50 dB.

2. Provide the following standard features:

ii. Automatic electronic shutter.

iii. Automatic gain control.

iv. Automatic white balance.

v. Web-based interface for remote viewing and setup.

vi. Password protected security access.

D. Camera Enclosures and Mounting Brackets:

1. Where not factory-installed, provide accessory camera enclosures suitable for operation under the service conditions at the installed location.

2. Where not factory-installed, provide accessory camera mounting brackets necessary for installation.

2.05 ACCESSORIES

A. Provide components as indicated or as required for connection of video surveillance system to devices and other systems indicated.

B. Provide network switches as required for network connections to system components.

C. Provide cables as indicated or as required for connections between system components.

D. Provide accessory racks/cabinets as indicated or as required for equipment mounting.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings and configurations of system components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive system components.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to system.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install video surveillance system in accordance with NECA 1 (general workmanship) and NECA 303.

B. Provide required support and attachment in accordance with Section 26 0529.

C. Provide grounding and bonding in accordance with Section 26 0526.

D. Identify system wiring and components in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

A. Prepare and start system in accordance with manufacturer's instructions.

B. Adjust cameras to provide desired field of view and produce suitable images under all service lighting conditions.

C. Program system parameters according to requirements of Owner.

D. Test for proper interface with other systems.

E. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

3.04 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 3.05 PROTECTION

A. Protect installed system components from subsequent construction operations.

3.06 MAINTENANCE

A. Provide to Owner, a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of video surveillance system for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

B. Provide trouble call-back service upon notification by Owner:

1. Include allowance for call-back service during normal working hours at no extra cost to Owner.
2. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

END OF SECTION

SECTION 28 31 00

FIRE DETECTION AND ALARM

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. This Section includes Fire alarm system design and installation, including all components, wiring, and conduit.

1.03 DEFINITIONS

A. FACP: Fire alarm control panel.

B. LED: Light-emitting diode.

C. NICET: National Institute for Certification in Engineering Technologies.

D. Definitions in NFPA 72, 2013 Edition, apply to fire alarm terms used in this Section.

1.04 SYSTEM DESCRIPTION

A. Noncoded, analog-addressable system; automatic sensitivity control of certain smoke detectors; and multiplexed signal transmission dedicated to fire alarm service only.

1. Interface with existing fire alarm system.

1.05 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 72, 1999 Edition, CBC, CFC & Titles 19 and 24 CCR.

B. Fire alarm signal initiation shall be by one or more of the following devices:

1. Manual stations.
2. Heat detectors.
3. Flame detectors.
4. Smoke detectors.
5. Verified automatic alarm operation of smoke detectors.
6. Automatic sprinkler system water flow.
7. Fire extinguishing system operation.
8. Fire standpipe system.

C. Fire alarm signal shall initiate the following actions:

1. Alarm notification appliances shall operate continuously.
2. Identify alarm at the FACP and remote annunciators.
3. De-energize electromagnetic door holders.
4. Transmit an alarm signal to the remote alarm receiving station.
5. Unlock electric door locks in designated egress paths.
6. Release fire and smoke doors held open by magnetic door holders.
7. Activate voice/alarm communication system.

8. Switch heating, ventilating, and air-conditioning equipment controls to fire alarm mode.
9. Close smoke dampers in air ducts of system serving zone where alarm was initiated.
10. Record events in the system memory.
11. Record events by the system printer.

D. Supervisory signal initiation shall be by one or more of the following devices or actions:
1. Operation of a fire-protection system valve tamper.

E. System trouble signal initiation shall be by one or more of the following devices or actions:
1. Open circuits, shorts and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.
2. Opening, tampering, or removal of alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at the FACP.
4. Ground or a single break in FACP internal circuits.
5. Abnormal ac voltage at the FACP.
6. A break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at the FACP or annunciator.
9. Fire-pump power failure, including a dead-phase or phase-reversal condition.
10. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.

F. System Trouble and Supervisory Signal Actions: Ring trouble bell and annunciate at the FACP and remote annunciators. Record the event on system printer.

1.06 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:
1. Shop Drawings shall be prepared by persons with the following qualifications:
i. Trained and certified by manufacturer in fire alarm system design.
ii. Fire alarm certified by NICET, minimum Level III.
2. System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
3. Device Address List: Coordinate with final system programming.
4. System riser diagram with device addresses, conduit sizes, and cable and wire types and sizes.
5. Wiring Diagrams: Power, signal, and control wiring. Include diagrams for equipment and for system with all terminals and interconnections identified. Show wiring color code.
6. Batteries: Size calculations.
7. Duct Smoke Detectors: Performance parameters and installation details for each detector, verifying that each detector is listed for the complete range of air velocity,

temperature, and humidity possible when air-handling system is operating.

8. Ductwork Coordination Drawings: Plans, sections, and elevations of ducts, drawn to scale and coordinating the installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, the detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
9. Floor Plans: Indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

C. Qualification Data: For Installer.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For fire alarm system to include in emergency, operation, and maintenance manuals. Comply with NFPA 72, Appendix A, recommendations for Owner's manual. Include abbreviated operating instructions for mounting at the FACP.

F. Submittals to Authorities Having Jurisdiction: In addition to distribution requirements for submittals specified in Division 01 Section "Submittals," make an identical submittal to authorities having jurisdiction. To facilitate review, include copies of annotated Contract Drawings as needed to depict component locations. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Architect for review.

G. Documentation:

1. Approval and Acceptance: Provide the "Record of Completion" form according to NFPA 72 to Owner, Architect, and authorities having jurisdiction.
2. Record of Completion Documents: Provide the "Permanent Records" according to NFPA 72 to Owner, Architect, and authorities having jurisdiction. Format of the written sequence of operation shall be the optional input/output matrix.
    i. Hard copies on paper to Owner, Architect, and authorities having jurisdiction.
    ii. Electronic media may be provided to Architect and authorities having jurisdiction.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.08 PROJECT CONDITIONS

A. Interruption of Existing Fire Alarm Service: Do not interrupt fire alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:

1. Notify Architect no fewer than fourteen days in advance of proposed interruption of fire alarm service.
2. Do not proceed with interruption of fire alarm service without Architect's and Owner's written permission.

1.09 SEQUENCING AND SCHEDULING

A. Existing Fire Alarm Equipment: Maintain fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is

accepted. Remove labels from new equipment when put into service and label existing fire alarm equipment "NOT IN SERVICE" until removed from the building.

B. Equipment Removal: After acceptance of the new fire alarm system, remove existing disconnected fire alarm equipment.

1.10 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but not less than 1 unit.
2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but not less than 1 unit.
3. Smoke, Fire, and Flame Detectors: Quantity equal to 10 percent of amount of each type installed, but not less than 1 unit of each type.
4. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but not less than 1 unit of each type.
5. Keys and Tools: One extra set for access to locked and tamperproofed components.
6. Audible and Visual Notification Appliances: One of each type installed.
7. Fuses: Two of each type installed in the system.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

2.02 EXISTING FIRE ALARM SYSTEM

A. Compatibility with Existing Equipment: Fire alarm system and components shall operate as an extension of an existing system.

2.03 MANUAL FIRE ALARM BOXES

A. Description: UL 38 listed; finished in red with molded, raised-letter operating instructions in contrasting color. Station shall show visible indication of operation. Mounted on recessed outlet box; if indicated as surface mounted, provide manufacturer's surface back box.

1. Single-action mechanism, breaking-glass or plastic-rod or pull-lever type. With integral addressable module, arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP.
2. Double-action mechanism requiring two actions to initiate an alarm, breaking-glass or plastic-rod or pull-lever type. With integral addressable module, arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP.
3. Station Reset: Key- or wrench-operated switch.
4. Indoor Protective Shield: Factory-fabricated clear plastic enclosure, hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
5. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure, hinged at the top to permit lifting for access to initiate an alarm.

2.04 SYSTEM SMOKE DETECTORS

A. General Description:

1. UL 268 listed, operating at 24-V dc, nominal.

2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
3. Multipurpose type, containing the following:
    i. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
    ii. Piezoelectric sounder rated at 88 dBA at 10 feet (3 m) according to UL 464.
    iii. Heat sensor, combination rate-of-rise and fixed temperature.
4. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection of building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type. Indicating detector has operated and power-on status.
7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.
    i. Rate-of-rise temperature characteristic shall be selectable at the FACP for 15 or 20 deg F (8 or 11 deg C) per minute.
    ii. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at the FACP to operate at 135 or 155 deg F (57 or 68 deg C).
    iii. Provide multiple levels of detection sensitivity for each sensor.

B. Photoelectric Smoke Detectors:
1. Sensor: LED or infrared light source with matching silicon-cell receiver.
2. Detector Sensitivity: Between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) smoke obscuration when tested according to UL 268A.

C. Duct Smoke Detectors:
1. Photoelectric Smoke Detectors:
    i. Sensor: LED or infrared light source with matching silicon-cell receiver.
    ii. Detector Sensitivity: Between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) smoke obscuration when tested according to UL 268A.
2. UL 268A listed, operating at 24-V dc, nominal.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
4. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. The fixed base shall be designed for mounting directly to the air duct. Provide terminals in the fixed base for connection to building wiring.
    i. Weatherproof Duct Housing Enclosure: UL listed for use with the supplied detector. The enclosure shall comply with NEMA 250 requirements for Type 4X.
5. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.

6. Integral Visual-Indicating Light: LED type. Indicating detector has operated and power-on status. Provide remote status and alarm indicator and test station where indicated.

7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.

8. Each sensor shall have multiple levels of detection sensitivity.

9. Sampling Tubes: Design and dimensions as recommended by manufacturer for the specific duct size, air velocity, and installation conditions where applied.

10. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.05 HEAT DETECTORS

A. General: UL 521 listed.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or rate-of-rise of temperature that exceeds 15 deg F (8 deg C) per minute, unless otherwise indicated.

1. Mounting: Plug-in base, interchangeable with smoke-detector bases.

2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F (88 deg C).

1. Mounting: Adapter plate for outlet box mounting or Plug-in base, interchangeable with smoke-detector bases.

2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

D. Continuous Linear Heat-Detector System: Consists of detector cable and control unit.

1. Detector Cable: Rated detection temperature 155 deg F (68 deg C). Listed for "regular" service and a standard environment. Cable includes two steel actuator wires twisted together with spring pressure, wrapped with protective tape, and finished with PVC outer sheath. Each actuator wire is insulated with heat-sensitive material that reacts with heat to allow the cable twist pressure to short circuit wires at the location of elevated temperature.

2. Control Unit: Two-zone or multizone unit as indicated. Provides same system power supply, supervision, and alarm features as specified for the central FACP.

3. Signals to the Central FACP: Any type of local system trouble is reported to the central FACP as a composite "trouble" signal. Alarms on each detection zone are individually reported to the central FACP as separately identified zones.

4. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

2.06 NOTIFICATION APPLIANCES

A. Description: Equipped for mounting as indicated and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly.

2. Revise sound-level values in first four paragraphs below to comply with local interpretations of ADA requirements. See Editing Instruction No. 10 in the

Evaluations.

B. Bells: Electric-vibrating, 24-V dc, under-dome type; with provision for housing the operating mechanism behind the bell. Bells shall produce a sound-pressure level of 94 dBA, measured 10 feet (3 m) from the bell. 10-inch (254-mm) size, unless otherwise indicated. Bells are weatherproof where indicated.

C. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.

D. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.

E. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn.

F. Visible Alarm Devices: Xenon strobe lights listed under UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.

1. Rated Light Output: candela as indicated on drawings.
2. Strobe Leads: Factory connected to screw terminals.

2.07 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module listed for use in providing a system address for listed alarm-initiating devices for wired applications with normally open contacts.

B. Integral Relay: Capable of providing a direct signal to the elevator controller to initiate elevator recall and to a circuit-breaker shunt trip for power shutdown.

2.08 WIRE AND CABLE

A. Wire and cable for fire alarm systems shall be UL listed and labeled as complying with CEC, Article 760.

B. Signaling Line Circuits: Twisted, shielded pair, No. 14 AWG or as indicated on drawings.

1. Circuit Integrity Cable: Twisted shielded pair, CEC Article 760, Classification CI, for power-limited fire alarm signal service. UL listed as Type FPL, and complying with requirements in UL 1424 and in UL 2196 for a 2-hour rating.

C. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.

1. Low-Voltage Circuits: No. 16 AWG, minimum.
2. Line-Voltage Circuits: No. 12 AWG, minimum.
3. Multiconductor Armored Cable: CEC Type MC, copper conductors, TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, UL listed for fire alarm and cable tray installation, plenum rated, and complying with requirements in UL 2196 for a 2-hour rating.

PART 3 - EXECUTION

3.01 EQUIPMENT INSTALLATION

A. Connecting to Existing Equipment: Verify that existing fire alarm system is operational before making changes or connections. ExistingFACP location shall be field verified.

1. Connect new equipment to the existing control panel in the existing part of the building.
2. Connect new equipment to the existing monitoring equipment at the Supervising

Station.

3. Expand, modify, and supplement the existing control equipment as necessary to extend the existing control functions to the new points. New components shall be capable of merging with the existing configuration without degrading the performance of either system.

B. Smoke or Heat Detector Spacing:

1. Smooth ceiling spacing shall not exceed 30 feet (9 m) and the rating of the detector.

2. Spacing of heat detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas, shall be determined according to Appendix A in NFPA 72.

3. Spacing of heat detectors shall be determined based on guidelines and recommendations in NFPA 72.

C. HVAC: Locate detectors not closer than 3 feet (1 m) from air-supply diffuser or return-air opening.

D. Duct Smoke Detectors: Comply with NFPA 72,NFPA 90A and CMC. Install sampling tubes so they extend the full width of the duct.

E. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.

F. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.

G. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

H. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

I. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling.

J. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.02 WIRING INSTALLATION

A. Install wiring according to the following:

1. NECA 1.

2. TIA/EIA 568-A.

3. CEC

B. Wiring Method: Install wiring in metal raceway according to Section 26 0533.13 - Conduit for Electrical Systems

1. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.

C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs,

pressure-type terminal blocks, or plug connectors.

D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

E. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

F. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum 1-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.

G. Wiring to Remote Alarm Transmitting Device: 1-inch (25-mm) conduit between the FACP and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.03 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals according to Section 26 0553 - Identification for Electrical Systems.

B. Install instructions frame in a location visible from the FACP.

C. Paint power-supply disconnect switch red and label "FIRE ALARM."

3.04 GROUNDING

A. Ground the FACP and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to the FACP.

3.05 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

C. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:

D. Perform the following field tests and inspections and prepare test reports:

1. Before requesting final approval of the installation, submit a written statement using the form for Record of Completion shown in NFPA 72.
2. Perform each electrical test and visual and mechanical inspection listed in NFPA 72. Certify compliance with test parameters. All tests shall be conducted under the direct supervision of a NICET technician certified under the Fire Alarm Systems program at Level III.
3. Include the existing system in tests and inspections.
4. Visual Inspection: Conduct a visual inspection before any testing. Use as-built drawings and system documentation for the inspection. Identify improperly located, damaged, or nonfunctional equipment, and correct before beginning tests.
5. Testing: Follow procedure and record results complying with requirements in NFPA 72.
    i. Detectors that are outside their marked sensitivity range shall be replaced.

6. Test and Inspection Records: Prepare according to NFPA 72, including demonstration of sequences of operation by using the matrix-style form in Appendix A in CEC.

3.06 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project outside normal occupancy hours for this purpose.

B. Follow-Up Tests and Inspections: After date of Substantial Completion, test the fire alarm system complying with testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for three monthly, and one quarterly, periods.

C. Work in two paragraphs below is normally the responsibility of Owner. Retain one or both paragraphs if Owner needs additional time for inspections required by NFPA 72.

D. Semiannual Test and Inspection: Six months after date of Substantial Completion, test the fire alarm system complying with the testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

E. Annual Test and Inspection: One year after date of Substantial Completion, test the fire alarm system complying with the testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for monthly, quarterly, semiannual, and annual periods. Use forms developed for initial tests and inspections.

3.07 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the fire alarm system, appliances, and devices. Refer to Division 01 Section "Demonstration and Training."

3.08 DOCUMENTATION

A. Provide an NFPA Certificate of compliance to Local Fire Marshal and Owner.

END OF SECTION

SECTION 28 31 11

BUILDING INTRUSION DETECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Intrusion detection system requirements.

B. Alarm control unit.

C. Keypads.

D. Initiating devices.

E. Alarm notification appliances.

F. Accessories.

1.02 1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate compatibility of devices for the installed locations with work provided under other sections or by others.

2. Coordinate the placement of sensors and keypads with millwork, furniture, equipment, etc. installed under other sections or by others.

3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install sensors and keypads until final surface finishes and painting are complete.

1.05 1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each system component. Include ratings, configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.

1. Motion Detectors: Include detailed motion detection coverage range diagrams.

C. Shop Drawings: Include plan views indicating locations of system components and proposed size, type, and routing of conduits and/or cables. Include system interconnection schematic diagrams. Include requirements for interface with other systems.

D. Design Data: Include standby battery calculations.

E. Certify that proposed system design and components meet or exceed specified requirements.

F. Evidence of qualifications for maintenance contractor (if different entity from installer).

G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

H. Maintenance contracts.

I. Software: One copy of software not resident in read-only memory.

1.06 1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with intrusion detection systems of similar size, type, and complexity and providing contract maintenance service as a regular part of their business; authorized representative of control unit manufacturer.

1.07 1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.08 1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 1.09 WARRANTY

A. Provide minimum two year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 - PRODUCTS

2.01 2.01 INTRUSION DETECTION SYSTEM REQUIREMENTS

A. Design and provide new intrusion detection system consisting of all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Keypads: Located as directed by Owner

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B, consumer application.

2.02 2.02 ALARM CONTROL UNIT

A. Manufacturers:

1. Addressable Alarm Control Panel - : Make and Model shall be capatible with existing building Intrusion Alarm System. Both New and Existing systems shall be networked together..

B. Alarm Initiating Circuits: Supervised.

1. Hardwired Zones: Supports both normally closed and normally open conventional (non-addressable) initiating devices.

C. Alarm Notification Circuits: Supervised.

D. Communications Interfaces: Supervised.

1. Supports system reporting to central station receivers via integral interface or accessory interface modules using:

i. Telephone lines.

E. Keypads: Supervised.

F. Peripheral Devices: Supervised; provide tamper protection.

G. Output Relays:

1. Relay Modules: Form C relays (normally open and normally closed); provide tamper protection.

2. Programmable to respond to system events, according to defined scheduling, or by manual activation from keypad.

H. User Codes:

1. Each user code to be individually assignable to any defined authority level for configurable access to system features and functions.

I. Scheduling:

1. Provide time/calendar-based scheduling capability for automated system control.

2. Supports open/close schedules for control of arming/disarming and reporting.

3. Supports timed events including, but not limited to:

ii. Point bypass/unbypass.

iii. Relay activate/deactivate.

J. Event Log:

1. Stores system events including time, date, partition, zone, and user code where applicable.

2. Supports viewing of event log on keypads.

2.03 2.03 KEYPADS

A. Manufacturer: Same as manufacturer of alarm control unit.

B. Provides interface to alarm control unit for system control and remote annunciation.

C. Provides visual notification of system status and zone information.

D. Provides audible notification to indicate system status, entry/exit delay, and alarm situations; provide separate distinguishable sounds for alarm and trouble conditions.

E. Keypad Type: Only LCD or graphic touch screen keypads are acceptable. Do not use LED keypads.

F. Graphic Touch Screen Keypads: Displays system status and zone information using plain English on graphic display; touch screen interface.

G. LCD Keypads: Displays system status and zone information using plain English on alphanumeric display; illuminated keys.

2.04 2.04 INITIATING DEVICES

A. Manufacturers: Same as manufacturer of alarm control units where possible.

B. General Requirements:

1. Provide devices suitable for intended application and location to be installed.

2. Outdoor Units: Weather resistant, suitable for outdoor use.

2.05 2.05 ALARM NOTIFICATION APPLIANCES

A. Manufacturers: Same as manufacturer of alarm control units where possible.

B. Provide alarm notification appliances suitable for connection to control unit outputs.

C. Outdoor Units: Weather resistant, suitable for outdoor use.

2.06 2.06 ACCESSORIES

A. Provide components as indicated or as required for connection of alarm control unit to devices and other systems indicated.

B. Provide cables as indicated or as required for connections between system components.

C. Provide end-of-line resistors (EOLR) as required for supervision of hardwired zones.

PART 3 - EXECUTION

3.01 3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings and configurations of system components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive system components.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to system.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Provide grounding and bonding in accordance with Section 26 0526.

D. Identify system wiring and components in accordance with Section 26 0553.

3.03 3.03 FIELD QUALITY CONTROL

A. Prepare and start system in accordance with manufacturer's instructions.

B. Inspection and testing to include, at a minimum:

1. Test each initiating device for proper response by alarm control unit.

2. Test for proper operation of alarm notification appliances.

3. Test for proper operation of output relays.

C. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

3.04 3.04 ADJUSTING

A. Program system parameters according to requirements of Owner.

3.05 3.05 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.06 3.06 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.

B. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

2. Provide minimum of four hours of training.

3.07 3.07 PROTECTION

A. Protect installed system components from subsequent construction operations.

3.08 3.08 MAINTENANCE

A. Provide to Owner, a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of intrusion detection system for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

B. Conduct site visit at least once every three months to perform inspection, testing, and preventive maintenance. Submit report to Owner indicating maintenance performed along with evaluations and recommendations.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Removal of vegetation, grass, grass roots, shrubs, tree stumps, trees, upturned stumps, weed growth, tree roots, brush, masonry, concrete, rubbish, debris and other materials.

2. Removal of concrete and bituminous surfaces.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 31 2200 - Grading.

3. Section 31 2313 - Excavation and Fill.

4. Section 31 2316 - Excavation and Fill for Pavement.

5. Section 31 2326 - Base Course.

6. Section 32 9000 - Planting.

1.02 SUBMITTALS

A. Shop Drawings: Submit site plan indicating extent of site clearing.

1.03 QUALITY ASSURANCE

A. Comply with Standard Specifications for Public Works Construction, current edition, as a minimum requirement.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 TREE AND STUMP REMOVAL

A. Remove trees and stumps indicated or required to be removed. Remove trees, together with bulk of roots, to a minimum depth of 4 feet below required grade, and within a radius of approximately 7 feet beyond perimeter of trunk at grade.

B. Fill and compact excavation from tree and stump removal. Fill in 6 inch layers, each compacted to 90 percent of maximum density in accordance with ASTM D1557.

1. Back filling shall not commence until the excavation is inspected and tested.

3.02 CONCRETE AND BITUMINOUS SURFACING REMOVAL

A. Break up and completely remove existing concrete surfacing, curbs, gutters, walks and bituminous surfacing to indicated limits. Cutting shall be performed to a neat and even line with proper tools or a concrete cutting saw. Minimum depth of cut shall be 1 1/2-inch, unless otherwise indicated. Remove concrete broken beyond the indicated limits to the nearest joint or score line and replace with new concrete to match existing.

3.03 CLEANUP

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

END OF SECTION

SECTION 31 22 00

GRADING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. General exterior grading, cutting and filling, including grading for building area, paving, planting areas, banks and hillsides.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 31 1000 - Site Clearing.
3. Section 31 2313 - Excavation and Fill.
4. Section 31 2316 - Excavation and Fill for Pavement.
5. Section 31 2326 - Base Course.
6. Section 32 9000 - Planting.

1.02 PROJECT REQUIREMENTS

A. General:

1. Fees: Pay as required by authorities having jurisdiction over the area.
2. Bonds: Post as required by authorities having jurisdiction over the area.
3. Haul Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.
4. Before grading, contact Underground Service Alert of Southern California (USASC) for information on public buried utilities and pipelines. Retain the services of an underground utility locator for on-site utilities.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials shall conform to requirements specified in this and related sections.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect and maintain installed stakes until their removal is required for the Work. Provide replacement grade or location stakes lost or disturbed.

B. Install grade stakes and compare to indicated grades. If discrepancies are found between existing grades and grades indicated on Drawings, do not proceed until discrepancies are resolved.

3.02 ROUGH AND FINE GRADING

A. Rough grade area sufficiently high to require cutting by fine grading:

1. Grade area for bituminous surfacing and other paving to the indicated grades, equal to the section of the indicated base and pavement.

2. Slope banks to required finish grades as cut progresses or leave cuts full and finish grade by mechanical equipment to provide grades and soil densities indicated on the Drawings.

3. Rough grade, fill and compact banks beyond indicated finish grades. Finish grade banks and slopes to indicated grades and specified soil densities.

4. Grade Only Areas: In areas not indicated to receive pavement, rough grade to approximate finish grades and then scarify, moisten and roll to obtain required density and indicated finish grades.

5. Tolerances: Finish grades shall be within a tolerance of 0.05 inch per foot above or below grades indicated. Provide an average grade as indicated.

B. Base or Subgrade:

1. After subgrade has been constructed to approximate required grades, scarify to a depth of at least 6 inches:

a. After scarifying, process loosened material to a finely divided condition and adjust moisture content to optimum condition by addition of water, addition and blending of dry suitable material, or by drying of existing material.

b. Subgrade material shall be compacted by tamping, sheepsfoot rollers or pneumatic tire rollers. Required relative compaction shall be [**90**] percent minimum for the top 6 inches below subgrade.

c. Install base course in accordance with Section 31 2326 - Base Course.

2. Tolerance of completed grades of base or subgrade shall not vary more than 0.03 inch per foot from grades indicated. Provide an average grade as indicated.

3.03 SHORING

A. Provide shoring as necessary to properly and safely support earth sides of excavations, and existing curbs, sidewalks, gutter, drives and stairs, against movement and collapse.

B. Design and Calculations: Provide in accordance with requirement of CalOHSA.

C. Remove shoring upon completion of the Work of this section or when no longer needed unless required otherwise by authorities having jurisdiction.

3.04 EXCESS MATERIAL DISPOSAL

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

3.05 PROTECTION

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

END OF SECTION

SECTION 31 23 13

EXCAVATION AND FILL

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Excavating, filling, backfilling, and compacting for Project site pavement, planting areas, buildings, and other structures.

2. Trenches for utility lines such as water, gas, irrigation, storm drain and sewer lines, concrete-encased conduits, manholes, vaults, valve boxes, catch basins, underground tanks, thrust blocks, yard boxes, pull boxes, and other utility appurtenances.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 01 4524 - Environmental Import/Export Materials Testing.
3. Section 31 1000 - Site Clearing.
4. Section 31 2200 - Grading.
5. Section 31 2326 - Base Course.
6. Section 32 1313 - Site Concrete Work.
7. Section 32 9000 - Planting.

1.02 PROJECT REQUIREMENTS

A. Import and Export of Earth Materials:

1. Fees: Pay as required by authorities having jurisdiction over the area.
2. Bonds: Post as required by authorities having jurisdiction over the area.
3. Haul Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.

1.03 SUBMITTALS

A. Shoring calculations as required in Article 3.03 of this Section.

1.04 QUALITY ASSURANCE

A. Comply with the Standard Specifications for Public Works Construction, current edition, except as modified herein.

B. Sampling, testing, and certification of imported and exported soils shall be performed in accordance with Section 01 4524, Environmental Import/Export Materials Testing.

1.05 TESTING

A. OWNER will retain a Geotechnical Engineer as an OWNER Consultant who will provide observations, tests, inspections and approvals identified in the Contract Documents as being responsibility of OWNER.

B. Imported Soils: The Geotechnical Engineer will obtain initial product Sample for testing in accordance Article 3.05 of this Section.

1.06 PROJECT CONDITIONS

A. Information on Drawings or in soil investigation report does not constitute a guarantee of accuracy or uniformity of soil conditions over the Project site.

PART 2 - PRODUCTS

2.01 FILL AND BACKFILL MATERIALS

A. Fill and backfill material shall be a granular material previously removed from excavation or imported fill material, free of clods and stones larger than 3 inches, (2½ inches for utility trenches) foreign materials, vegetable growths, sod, expansive soils, rubbish and debris. Material shall conform to these specified requirements and related sections.

B. Fill material exhibiting a wide variation in consistency and moisture content shall be blended and aerated to stabilize and upgrade the material.

C. Bedding material from trench bottom to one foot above the pipe:

1. Sand, gravel, crushed aggregate or native free-draining granular material providing a sand equivalent of at least 30 or a coefficient of permeability greater than 1.4 inches per hour.

2. Sand complying with the Specifications for cement concrete aggregates.

D. Brick rubble and broken concrete originating from the Project site shall be legally disposed of off the Project site No such material shall be imported from outside the Project site.

E. Permeable Backfill:

1. Provide permeable backfill material behind retaining structures consisting of gravel, crushed gravel, crushed rock, natural sands, manufactured sand, or combinations of these materials conforming to the following gradations:

Sieve Size:	Percentage Passing:
3/4 inch (19mm)	100
3/8 inch (10mm)	80 to 100
No. 100	0 to 8
No. 200	0 to 3

2. Those portions of fill material passing a No. 4 sieve shall provide a sand equivalent of at least 60.

3. Provided backing for weep-holes shall consist of two cubic feet of aggregate in burlap sacks, securely tied. Aggregate shall conform to requirements for No. 3 concrete aggregate as specified in subsection 200-1.4 of the Standard Specifications for Public Works Construction.

4. Permeable Backfill Alternate Materials: Instead of the materials specified for retaining structures backfill, a drainage matting system Miradrain by Mirafi, Inc., American Wick Drain, JDR Enterprises, or equal, may be provided if reviewed and approved by the ARCHITECT.

F. Cement-sand slurry shall be provided with one sack of cement per cubic yard of the mixture.

2.02 BASE MATERIALS

A. Concrete Slabs on Grade: Provide "Crushed Aggregate Base" as specified in Standard Specifications for Public Works Construction, Section 200 - Rock Materials, with 3/4 inch maximum size aggregates. Provide 3 inch thick base, unless noted otherwise.

B. Bituminous Surfacing: Provide as indicated on Drawings and specified in Section 31 2326 Base Course.

PART 3 - EXECUTION

3.01 GENERAL

A. Before initiating intrusive activities, contact Underground Service Alert of Southern California (USA or Dig Alert) to obtain a Dig Alert ticket for location information on buried public and USA member utilities and pipelines at least 48-hours prior to beginning work. A copy of the Dig Alert ticket shall be forwarded to the OWNER. For on-site utilities, retain a state-licensed third party underground utility locating service.

B. Where the Work includes a building extension or addition on an occupied Project site, perform Work in such a manner, and at such times, as not to disrupt performance of existing utility services to existing Project site facilities. Where an interruption is necessary, obtain review from the OAR before proceeding.

C. Remove concrete or bituminous pavement to straight lines by saw cutting.

3.02 PROTECTION

A. Protect and guard excavations against danger to life, limb, and property as required by, but not limited to, OSHA regulations.

B. Protect existing improvements including landscaping against damage. Repair or replace damaged items.

C. Protect existing utility services and distribution systems from damage or displacement.

D. Remove conduits or pipes not in service, exposed during Work, unless a minimum cover of two feet is provided. Remove concrete, clay or other non-metallic pipe over 8 inches in diameter, unless otherwise indicated.

E. Shore, crib, or lag excavations and earthen banks as necessary to prevent cave in, erosion or gullying of sides.

F. Provide excavations free from standing water by pumping, draining, or providing protection against water intrusion. If soil becomes soft, soggy, or saturated, excavate to firm undisturbed earth and fill as required. Slope adjacent grades away from excavations to minimize entry of water.

3.03 SHORING

A. Provide shoring as necessary to properly and safely support earth sides of excavations, and existing curbs, sidewalks, gutter, drives and stairs, against movement and collapse.

B. Design and Calculations: Provide in accordance with requirement of governing Cal-OSHA requirements.

C. Remove shoring upon completion of the Work of this Section or when no longer needed unless required otherwise by authorities having jurisdiction.

3.04 EXCAVATION

A. Unclassified Excavations: Comply with the Standard Specifications for Public Works Construction, Section 300: "Earthwork", except as modified herein.

B. Form sides of footings, pads, grade beams, and slab foundations, unless otherwise indicated. Provide excavations of sufficient size to permit installation and removal of forms and other required Work.

C. Machine-drill excavation for round footings to size and depth indicated. Provide a collar or casing, or other adequate protection, to exclude dirt and debris. Protect excavations with plank covers until concrete is placed.

D. Provide excavation bottoms level and free from loose material. Excavate to indicated or required elevations of undisturbed earth.

E. Barricade trenches, ditches, pits, sumps, and similar Work outside the barricaded working area with chain link fence as specified in Section 01 5000 - Construction Facilities and Temporary Controls, and in accord with Cal-OSHA standards and requirements.

F. Trenches over five feet in depth shall comply with the Construction Safety Orders of the California Division of Industrial Safety.

G. Where indicated or required to excavate in lawn areas, protect adjoining lawn areas outside of the Work area. Replace or install removed sod upon completion of backfill by installing sod level with adjacent lawns. If installation of removed sod fails, furnish sod and install to match existing lawns.

3.05 IMPORT/EXPORT OF MATERIALS

A. Unclassified Fill and Compaction: Comply with the Standard Specifications for Public Works Construction, Section 300 - Earthwork, except as modified herein. Install and compact fill in layers not to exceed 6 inches in thickness.

B. Provide fill materials as specified in Part 2- Products. If excavated materials from the Project site are not of required quality or sufficient quantity, import additional materials as necessary.

C. In addition to the requirements of this Section, import and/or exported materials shall comply with the requirements of Section 01 4524, Environmental Import/Export Materials Testing.

D. Imported fill materials shall be sampled by the Geotechnical Engineer, for compliance with the requirements of Part 2 of this Section.

E. Initial sampling and testing shall be performed before importing material to the Project site. Identify the location of the source site in addition to the address, name of the person and entity responsible for the source site. The Geotechnical Engineer, will obtain both the initial and additional samples from the identified site and submit samples for required testing.

F. The Geotechnical Engineer will perform additional sampling during import operations. If the total quantity of import is determined to be greater than 1000 cubic yards of material, one sample shall be obtained and submitted for testing for each 250 cubic yards of imported material. If the total quantity of import is determined to be less than 1000 yards, one sample shall be obtained and submitted for testing for each 100 cubic yards of imported material.

G. The independent approved testing laboratory will perform the required tests and report results of tests noting if the tested material passed or failed such tests and will furnish copies to the Project Inspector, ARCHITECT, OAR, CONTRACTOR, and others as required. Report shall state tests were conducted under the responsible charge of a licensed State of California professional engineer and the material was tested in accordance with applicable provisions of the Contract Documents and California Building Code.

H. Bills of lading or equivalent documentation will be submitted to the Project Inspector on a daily basis.

I. Upon completion of import operations, provide the OAR a certification statement attesting that imported material has been obtained from the identified source site.

3.06 INSTALLATION OF MATERIALS

A. Pavement: Fill or backfill materials shall be installed in horizontal layers of 6 inches, unless otherwise required. Each layer shall be evenly placed and moistened or aerated as necessary. Unless otherwise reviewed by the Geotechnical Engineer, each layer of fill material shall cover the length and width of the area to be filled before the next layer of material is installed. Top surface of each layer shall be installed to an approximate level with a crown or crossfall of at least 1 in 50, but not more than 1 in 20. Provide adequate drainage at all times during installation of the Work of this Section.

3.07 COMPACTING

A. Each layer of fill material shall be compacted by tamping, sheepsfoot rollers, or pneumatic-tired rollers to provide specified relative compaction. At inaccessible locations, provide specified compaction by manually held, operated and directed compaction equipment.

B. Install and compact sand bedding to provide a uniform bearing under the full length of piping and conduits.

C. Unless otherwise indicated, compact each layer of fill material to a relative compaction of at least ninety percent.

D. When fill materials, or a combination of fill materials, are encountered or provided which develop densely packed surfaces as a result of installation or compacting operations, scarify each layer of compacted fill before installing the next succeeding layer.

3.08 INSPECTION AND TESTING

A. The Geotechnical Engineer will inspect and test excavations, sample material quality for testing as set required in Part 2 and observe installation and compaction of fill materials.

B. The Geotechnical Engineer will sample imported fill materials from their designated source and submit samples to the independent approved testing laboratory before delivery to the Project site.

C. Installation of backfill shall be observed by the Geotechnical Engineer.

D. The Geotechnical Engineer will inspect and test excavation Work before the installation of fill and other materials.

E. Compaction: Test compaction in accordance with ASTM D1557, Method C.

F. The Project Inspector will inspect foundation excavations when completed and ready for forms, after forms are in place, and before first placement of concrete.

3.09 PROTECTION

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

3.10 CLEANING

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

END OF SECTION

SECTION 31 23 16

EXCAVATION AND FILL FOR PAVING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Excavating, backfill, and compacting for paved areas.
2. Installation of fill materials.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 01 4524 - Environmental Import/Export Materials Testing.
3. Section 31 1000 - Site Clearing.
4. Section 31 2200 - Grading.
6. Section 32 2326 - Base Course.
7. Section 32 1313 - Site Concrete Work.

1.02 PROJECT REQUIREMENTS

A. Import and Export of Earth Materials:

1. Fees: Pay as required by authorities having jurisdiction over the area.
2. Bonds: Post as required by authorities having jurisdiction over the area.
3. Haul Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.

1.03 QUALITY ASSURANCE

A. Comply with Standard Specifications for Public Works Construction, current edition, except as modified herein.

B. Sampling, testing, and certification of imported and/or exported soils shall be performed in accordance with Section 01 4524 - Environmental Import/Export Materials Testing.

1.04 TESTING

A. OWNER will retain a Geotechnical Engineer as an OWNER Consultant who will provide observations, tests, inspections and approvals identified in the Contract Documents as being responsibility of OWNER.

B. Imported Soils: The Geotechnical Engineer will obtain initial product Sample for testing in accordance Article 3.05 of this Section.

1.05 PROJECT CONDITIONS

A. Information on Drawings or in soils report does not constitute a guarantee of accuracy or uniformity of soil conditions over the Project site.

PART 2 - PRODUCTS

2.01 BASE MATERIALS

A. Concrete Slabs On Grade: Provide "Crushed Aggregate Base "as specified in the Standard Specifications for Public Works Construction, Section 200: "Rock Materials," with ¾ inch maximum size aggregates. Provide 3-inch thick base, unless noted otherwise.

B. Bituminous Surfacing: As indicated on Drawings and specified in Section 31 2326 - Base Course.

2.02 FILL AND BACKFILL MATERIALS

A. Fill and backfill materials shall be previously excavated materials or imported fill material, free of clods and stones larger than 3-inch, foreign materials, vegetable growths, sod, expansive soils, rubbish and debris. Material shall conform to these specified requirements and related sections.

B. Fill material exhibiting a wide variation in consistency and moisture content shall be blended or aerated to stabilize and upgrade the material.

C. Imported Fill Material:

1. Provide suitable materials obtained from Project site excavations for earthwork and fill materials. If excavated materials are not of suitable quality or sufficient quantity, import additional materials as necessary.

2. Imported fill shall be a granular material with sufficient binder to form a firm and stable unyielding subgrade and shall not have more than 60 percent of fines passing 200 mesh sieve. Material shall have a coefficient of expansion of not more than 2 percent from air dry to optimum moisture content and not more than 6 percent from air dry to saturation. Imported material shall be clean and free of rubbish, debris, and toxic or hazardous contaminants. Adobe or clay soils are not permitted.

D. Brick rubble and broken concrete originating from the Project site shall be legally disposed of off the Project site. No such materials shall be imported from outside the Project site.

E. Permeable Backfill:

1. Provide permeable backfill material behind retaining structures consisting of gravel, crushed gravel, crushed rock, natural sands, manufactured sand, or combinations of these materials conforming to the following gradations:

Sieve Size:	Percentage Passing:
3/4 inch (19mm)	100
3/8 inch (10mm)	80 to 100
No. 100	0 to 8
No. 200	0 to 3

2. Those portions of fill material passing a No. 4 sieve shall provide a sand equivalent of at least 60.

3. Provided backing for weep holes shall consist of two cubic feet of aggregate in burlap sacks, securely tied. Aggregate shall conform to requirements for No. 3 concrete aggregate as specified in subsection 200-1.4 of the Standard Specifications for Public Works Construction.

4. Permeable Backfill Alternate Materials: Instead of the materials specified for retaining structures backfill, a drainage matting system, Miradrain by Mirafi, Inc., or equal, may be provided if reviewed and approved by the ARCHITECT.

PART 3 - EXECUTION

3.01 GENERAL

A. Before initiating intrusive activities, contact Underground Service Alert of Southern California (USA or Dig Alert) to obtain a Dig Alert ticket for location information on buried public and USA member utilities and pipelines at least 48-hours prior to beginning work. A copy of the Dig Alert ticket shall be forwarded to the OWNER. For on-site utilities, retain a state-licensed third party underground utility locating service.

B. Clear the Project site as indicated in Section 31 1000 - Site Clearing.

3.02 PROTECTION

A. Protect and guard excavations against danger to life, limb, and property as required by, but not limited to, Cal-OSHA regulations.

B. Protect adjacent existing improvements including landscaping against damage.

3.03 EXISTING UTILITY LINES

A. Protect existing utility lines from damage or displacement.

B. Remove conduits or pipes not in service, exposed during Work, unless a minimum cover of 2 feet is provided. Remove concrete, clay or other non-metallic pipe over 8 inches in diameter, unless otherwise indicated.

3.04 EXCAVATION

A. Unclassified Excavations: Comply with the Standard Specifications for Public Works Construction, Section 300: "Earthwork," except as modified herein.

3.05 FILL

A. Unclassified Fill and Compaction: Comply with the Standard Specifications for Public Works Construction, Section 300: "Earthwork," except as modified herein.

B. Provide fill materials as specified in Part 2 - Products. If excavated materials from the Project site are not of required quality or sufficient quantity, import additional materials as necessary.

C. In addition to the requirements of this Section, import and/or exported materials shall comply with the requirements of Section 01 4524 - Environmental Import/Export Materials Testing.

D. Imported fill materials will be sampled by the Geotechnical Engineer for compliance with the requirements of Part 2 of this Section.

E. Initial sampling will be performed by the Geotechnical Engineer before importing material to the Project site. Identify the location of the source site in addition to the address, name of the person and/or entity responsible for the source site. The Geotechnical Engineer will obtain both the initial and additional samples from the identified site and will submit samples to the approved independent testing laboratory for testing.

F. The Geotechnical Engineer will perform additional sampling during import operations. If the total quantity of import is determined to be greater than 1,000 cubic yards of material, one sample shall be obtained and submitted for testing for each 250 cubic yards of imported material. If the total quantity of import is determined to be less than 1,000 yards, one sample shall be obtained and submitted for testing for each 100 cubic yards of imported material.

G. The independent approved testing laboratory will perform the required tests and report results of tests noting if the tested material passed or failed such tests and will furnish copies to the Project Inspector, ARCHITECT, OAR, CONTRACTOR, and others as required. Report shall state tests were conducted under the responsible charge of a licensed State of California professional engineer and the material was tested in accordance with applicable provisions of the Contract Documents, and CBC.

H. Bills of lading or equivalent documentation will be submitted to the Project Inspector on a daily basis.

I. Upon completion of import operations, provide the OAR a certification statement attesting that imported material has been obtained from the identified source site.

3.06 INSTALLATION OF MATERIALS

A. Fill or backfill materials shall be installed in horizontal layers of 6 inches, unless otherwise required. Each layer shall be evenly placed and moistened or aerated as necessary. Unless otherwise reviewed by the Geotechnical Engineer, each layer of fill material shall cover the length and width of the area to be filled before the next layer of material is installed. Top surface of each layer shall be installed to an approximate level with a crown or crossfall of at least 1 in 50, but no more than 1 in 20. Provide adequate drainage at all times during construction of the Work of this Section.

3.07 COMPACTING

A. Each layer of fill material shall be compacted by tamping, sheepsfoot rollers, or pneumatic-tired rollers to provide specified relative compaction. At inaccessible locations, provide specified compaction by manually held, operated and directed compaction equipment.

B. Unless otherwise indicated, compact each layer of earth fill to a relative compaction of at least 90 percent.

C. When fill materials, or a combination of fill materials, are encountered or provided which develop densely packed surfaces as a result of installation or compacting operations, scarify each compacted layer before installing the next succeeding layer.

3.08 INSPECTION AND TESTING

A. The Geotechnical Engineer will inspect and test excavations, sample material quality as required in Part 2, and observe installation and compaction of fill materials.

B. The Geotechnical Engineer will sample imported fill materials from their designated source before delivery to the Project site.

C. Installation of backfill will be observed by the Geotechnical Engineer.

D. The Geotechnical Engineer will inspect and test excavation Work before the installation of fill and/or other materials.

E. Compaction: Test compaction in accordance with ASTM D1557, Method C.

3.09 PROTECTION

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

3.10 CLEANING

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

END OF SECTION

SECTION 31 23 26

BASE COURSE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Installation of base material.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 01 4524 – Environmental Import / Export Material Testing.
3. Section 31 1000 - Site Clearing.
4. Section 31 2200 - Grading.
5. Section 31 2313 - Excavation and Fill.
6. Section 31 2316 - Excavation and Fill for Paving.
7. Section 32 1313 - Site Concrete Work.

1.02 SUBMITTALS

A. Crushed aggregate base (CAB) shall consist of native rock without naturally occurring asbestos or recycled materials. The CONTRACTOR shall submit written documentation, which identifies the source, volume, and proposed transport date of the material for review and approval by OWNER'S Office of Environmental Health and Safety (OEHS) prior to importing the material. A statement on company letterhead from the CAB source, stamped by either a California Professional Geologist or Engineer, which states that the subject materials are native rock, do not contain any recycled materials and that the source quarry does not mine ultramafic materials, a source of natural occurring asbestos shall be included in the submittal to OEHS. The CONTRACTOR may request variance from analytical testing required by Section 01 4524 for CAB. To be considered for a variance, the CONTRACTOR shall submit a documentation package for OEHS approval, which includes all of the aforementioned information at least 48 hours in advance of planned import.

B. Product Data: Submit material source, technical information and test data for base materials. Gradation and quality certifications shall be dated within 30 days of the submittal.

C. Sample: Submit sample of proposed base course material.

1.03 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement: Standard Specifications for Public Works Construction, current edition.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Crushed Aggregate Base (CAB) materials shall conform to the requirements of the Standard Specifications for Public Works Construction: Section 200 - Rock Materials.

B. Crushed Miscellaneous Base (CMB) or materials generated on site shall not be used as a base course material.

2.02 MATERIAL APPROVAL

A. Base material shall be inspected by the Project Inspector for gradation and material content prior to installation. The OWNER may choose to have additional tests performed by a geotechnical engineer, retained by the OWNER, before installation.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install base course material in layers not exceeding 4 inches in thickness, unless required otherwise. Grade and compact to indicated levels or grades, cut and fill, water and roll until the surface is hard and true to line, grade and required section. Provide a relative compaction of at least 95 percent, unless otherwise required.

B. Grade base course to elevations indicated on Drawings, ready to receive surfacing, in accordance with Section 31 2200 - Grading.

3.02 PROTECTION

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

3.03 CLEANUP

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

END OF SECTION

SECTION 32 13 13

SITE CONCRETE WORK

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: On-site concrete work:

1. Portland cement concrete pavement, driveways, curbs, gutters and mowing strips.
2. Ramps and stairs on grade.
3. Footings for fence posts, bollards, flagpoles, shade structures, light standards and athletic and playground equipment.
4. Pipe encasements, thrust blocks, and equipment pads.
5. Retaining walls, planter walls and concrete benches.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 03 1000 – Concrete Forming and Accessories.
3. Section 03 2000 - Concrete Reinforcement.
4. Section 03 3000 – Cast-in-Place Concrete.
5. Section 07 9200 – Joint Sealants.
6. Section 31 2200 – Grading.
7. Section 31 2316 - Excavation and Fill for Pavement.
8. Section 31 2326 - Base Course.
9. Section 32 1723 – Pavement Markings.

1.02 REFERENCES

A. Structural work, such as retaining walls, planter walls, cast-in-place benches, equipment pads, and footings for playground equipment, fences, walls, shade structures and flagpoles shall conform to the following Sections:

1. Section 03 1000 Concrete Forming.
2. Section 03 2000 Concrete Reinforcing.

3. Section 03 3000 Cast-in-Place Concrete.

B. Flatwork, such as walkways, driveways, ramps and steps on grade, swales, curbs, mow strips and utility related concrete, conform to:

1. Standard Specifications for Public Works Construction, The "Greenbook", except reclaimed aggregates and processed miscellaneous base are not allowed.

C. Imported or exported earthwork shall conform to Section 01 4524 Environmental Import / Export Materials Testing.

D. National Ready Mixed Concrete Association (NRMCA):

1. Checklist for the Concrete Pre-Construction Conference.

1.03 QUALITY ASSURANCE

A. Source Limitations for Exposed Concrete: Obtain each color, size, type, and variety of concrete material and concrete mixture from single manufacturer with resources to provide concrete of consistent quality in appearance and physical properties. Secure material required for the duration of the project as needed to ensure consistent quality in appearance.

B. Pre-Installation Conference:

1. CONTRACTOR shall coordinate and conduct pre-installation conference in conformance to Section 01 3119 Project Meetings.

2. CONTRACTOR shall use the NRMCA "Checklist for the Concrete Pre-Construction Conference" as the meeting agenda.

C. Mockup:

1. Build 8 feet by 8 feet mockups of full-thickness sections of concrete paving using processes and techniques intended for use on permanent work, including curing procedures.

2. Build mockups to demonstrate typical joints; surface finishes and standard of workmanship.

3. Obtain ARCHITECT's approval of mockup before proceeding with work of this Section.

4. Mockup shall remain through completion of the work for use as a quality standard for finished work.

5. Remove mockup when directed by the Owner Authorized Representative.

D. Field applied primers, paintings, sealers, sealants, caulking, leveling and patching compounds, crack/joint repair compounds adhesives and similar products shall be approved by the OWNER's Office of Environmental Health and Safety (OEHS).

1.04 SUBMITTALS

A. Structural Work: Conform to the applicable requirements of Sections 03 1000 Concrete Forming, 03 2000 Concrete Reinforcing and 03 3000 Cast-in-Place Concrete.

B. Flatwork: Submit mix design in conformance to the Greenbook.

C. Shop Drawings: Submit drawings indicating the locations of concrete joints, including construction joints, expansion joints, isolation joints, and contraction joints.

1.05 DELIVERY, STORAGE AND HANDLING

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

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

C. Avoid exposure of reinforcing steel bars, wire, and wire fabric to dirt, moisture or conditions harmful to reinforcing.

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

PART 2 - PRODUCTS

2.01 MATERIALS

A. Structural Work: Conform to the applicable requirements of the following Sections, except as otherwise specified:

1. Section 03 1000 Concrete Forming.
2. Section 03 2000 Concrete Reinforcing.
3. Section 03 3000 Cast-in-Place Concrete.
4. Section 07 9200 Joint Sealants.

B. Flatwork: Conform to the applicable requirements of the Greenbook, Section 201, except as follows:

1. Water/cement ratio for concrete flatwork shall be 0.50 maximum.
2. Base course shall conform to Section 32 3226 Base Course.
3. Reclaimed concrete material shall not be used.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that gradients and elevations of base are correct. Maintain subgrade clean and in a smooth, compacted condition until the concrete is placed.

B. Maintain subgrade in a smooth, compacted condition in conformity with the required section and established grade until the concrete is placed. Earth surface shall be kept moist by frequent sprinkling up to the time of placing concrete.

3.02 CONSTRUCTION OF FORMS

A. Flatwork Forming: Set forms to the indicated alignment, grade and dimensions. Hold forms rigidly in place by a minimum of 4 stakes per form placed at intervals not to exceed two feet. Use additional stakes and braces at corners, deep sections, and radius bends, as required. Use clamps, spreaders, and braces where required to ensure rigidity in the forms.

B. Wall Formwork: Forms shall be constructed to conform to final concrete shape, lines and dimensions of members required by Drawings and Specifications. Forms shall be sufficiently tight to prevent leakage of concrete and properly braced or tied together to maintain position and shape.

3.03 STEEL REINFORCEMENT INSTALLATION

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

B. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

C. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces, and lace splices with wire.

D. Clean reinforcement of loose rust and mill scale, earth, or bond-reducing materials.

3.04 PREPARATION FOR CONCRETE PLACEMENT

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

B. Do not place concrete until forms, reinforcement, pipe, conduits, outlet boxes, anchors, sleeves, bolts, and other embedded materials are securely fastened in place. Maintain a minimum of two inches clearance between said items and any part of the concrete reinforcement.

C. Adjust pull boxes, meter boxes, valve covers and manholes to proposed finish grade prior to placement of concrete. Anchor bolts shall be accurately set and maintained in position by templates while being embedded in concrete.

D. Clean thoroughly the surfaces of metalwork to be in contact with concrete, remove dirt, grease, loose scale and rust, grout, mortar, and other foreign substances before the concrete is placed.

E. Moisten subbase to provide a uniform dampened condition at time concrete is placed.

3.05 CONCRETE PLACEMENT

A. Place, compact, screed, float and trowel concrete as indicated in Section 03 3000 Cast-in-Place Concrete.

B. Finish: After straightedging, when most of the water sheen has disappeared and just before the concrete hardens, finish the surface with a wood or magnesium float or darby to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. Produce a scored surface by brooming with a fiber-bristle brush in a direction transverse to that of the traffic, followed by edging.

1. Provide medium broom finish on surfaces up to six percent slope by striating surface 1/32 to 3/64 inch deep with a soft bristle broom across concrete surface to provide a uniform fine line texture.

2. Provide heavy broom finish on surfaces over six percent by striating surface 1/16 inch to 1/8 inch deep with a stiff-bristled broom.

3.06 JOINTS

A. Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated. Align curb, gutter, and sidewalk joints.

B. Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour.

1. Continue steel reinforcement across construction joints unless otherwise indicated on the Drawings.

2. Provide tie bars at sides of paving strips where indicated on the Drawings

3. Butt Joints: Use bonding agent or epoxy-bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.

5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated on the Drawings.

D. Expansion Joints:

1. Provide premolded joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together. Extend expansion joint fillers full-width and depth of joint, and 1/4" below finished surface where joint filler is indicated. If no joint sealer is indicated place top of premolded joint filler flush with top of concrete or curb.

2. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

E. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints to a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Remove grooving-tool marks on concrete surfaces.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

F. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Remove edging-tool marks on concrete surfaces.

G. Where concrete is to be cast against old concrete, (greater than 60 days of age), the surface of the old concrete shall be thoroughly cleaned and roughened by sand-blasting, exposing the aggregate. The hardened surface shall be cleaned of latent foreign material and washed clean, prior to the application of an epoxy bonding agent.

3.07 CLEAN UP

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

3.08 PROTECTION

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

END OF SECTIONS

SECTION 32 17 23.13

PAINTED PAVEMENT MARKINGS

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SUMMARY

Section includes Painted traffic striping and symbols on pavements and curbs.

1.03 REGULATORY REQUIREMENTS

Provide pavement markings meeting the accessibility requirements of the current California Building Code (CBC).

1.04 SUBSTITUTIONS

Substitutions will be considered per Section 01 25 00 Substitution Procedures.

1.05 SUBMITTALS

Provide in accordance with Section 01 33 00 Submittal Procedures.

1.06 PRODUCT HANDLING

A. Comply with the requirements of Section 01 66 00 Product Storage and Handling Requirements.
B. Deliver paints and paint materials in original sealed containers that plainly show the designated name, batch number, color, date of manufacture, manufacturer's directions, and name of manufacturer. Provide storage facilities at the project site for maintaining materials at temperatures recommended by the manufacturer.

1.07 ENVIRONMENTAL CONDITIONS

Do not apply paint when either air or pavement temperature is below 50 degrees F or above 95 degrees F; or when rain, fog, condensation, or temperatures below 50 degrees F are anticipated during the drying period.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Pavement Marking Paint: Vinyl acrylic type for use on asphaltic concrete and portland cement concrete, colors as indicated, specified herein, or required by CBC Title 24 Part 2.
B. Acceptable product or Architect approved equal: Dunn-Edwards Paints Vin-L-Stripe Zone Marking Paint.

PART 3 – EXECUTION

3.01 INSPECTION

A. Examine the areas and conditions under which work of this Section will be performed.
B. Verify that specified items may be installed in accordance with the approved design.
C. Correct conditions detrimental to timely and proper completion of the Work.
D. Do not proceed until unsatisfactory conditions are corrected.

E. Beginning of installation means acceptance of conditions.

3.02 PREPARATION

A. Immediately before applying the paint, thoroughly clean the pavement surface of dust, dirt, sand, scale, water, oil, grease or other objectionable matter. Do not use solvent material that will damage pavements as cleaning agents. Immediately before painting, give pavement surfaces a final cleaning by means of a power broom and a power blower using compressed air following the brooming.

B. Provide warning devices required to protect the painting operations and the finished work.

3.03 APPLICATION

A. Do not apply pavement markings until after sealer has been applied as specified in Section 03 35 00. Apply the paint only when the pavement is dry and clean. Under inclement weather conditions, or when temperature is below 50 degrees F, painting will not be permitted.

B. Equipment: Apply the traffic and parking striping [and game markings] with a traffic stripe painting machine with a compressor capacity of at least 105 cubic feet and capable of operating at an air pressure of 125 psi. Mechanically agitate paint while the machine is in operation. Equip the striping machine with a pointer so designed that the machine will hold exactly to the alignment. Equip the propelling vehicle with a speedometer or tachometer, and with a suitable device for determining the quantity of paint in the container. Thoroughly clean the paint container and spray nozzles on the machine before starting each day's work.
   1. Equipment used for applying reflectorized striping shall be equipped with a bead dispenser capable of applying the beads at the specified rate.
   2. Where the configuration or location of a traffic stripe is such that a striping machine is not suitable, use hand spraying equipment and stencils or templates.
   3. Apply paint for word markings, letters, numerals, and symbols using hand spraying equipment and stencils or templates.

C. Application: Immediately following the preparation of the pavement surface, apply the striping at the rate of 100 to 110 square feet per gallon of paint. Apply lines 4 inches wide unless otherwise indicated. Apply the stripe of the indicated or specified width, with clean true edges and without sharp breaks. Repaint, to the applicable specifications, portions of the stripe damaged by any type of traffic within 24 hours after the stripe has been applied.
   1. Provide International Symbol of Accessibility for each parking stall for the disabled at location indicated. Symbol shall be 36 inches square, white on standard blue background and shall conform to CBC Title 24 Part 2, Chapter 11; and ADA Accessibility Guidelines for Buildings and Facilities.
   2. Tactile warning lines shall be in conformance with CBC Section 1133B.8.3 and 1133B.8.4.

D. Tolerances: Apply striping within a tolerance of 1/2 inch in 50 feet. Apply markings and stripings to the widths indicated within a tolerance of 1/4 inch on straight sections and 1/2 inch on curved sections.

E. At completion touch up stripes and markings which are not clear and distinct or which are not uniform in color.

END OF SECTION

SECTION 32 17 26

TACTILE WARNING SURFACING

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SUMMARY

A. Perform all work required to complete, as indicated by the Contract Documents and furnish all supplementary items necessary for the proper installation of Precast Concrete Pavers.
B. System shall consist of precast concrete pavers installed on Latex thinset mortar setting bed.
C. The paver installation shall be absolutely rigid and even large slabs when subjected to vehicular traffic, shall not be displaced.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM)
    1. ASTM C 33: Specification for Concrete Aggregates
    2. ASTM C 150: Specification for Portland Cement
    3. ASTM C 67: Method of Sampling and Testing Brick and Structural Clay Tile
    4. ASTM C 140: Specification for concrete
B. T.C.A. Tile Council of America
    1. Installation Method Cement Mortar Bonded F102 - 95.
C. A.N.S.I. American National Standards Institute
    1. A-118.4 Latex Portland Cement Mortar
    2. A-118.6 Grout – Latex

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications:
    1. All products covered under this Section shall be produced by a single manufacturer unless otherwise specified.
    2. Manufacturer shall submit evidence of having not less than ten (10) years successful production of this product.
    3. The paver manufacturer shall demonstrate, either by proven field performance of the laboratory freeze-thaw test that the paving units have adequate durability if they are to be subjected to a freeze-thaw environment.
        a. Satisfactory field performance is indicated when units similar in composition and made with the same manufacturing process as those to be supplied to the purchaser, do not exhibit objectionable deterioration after at least 3 years.
        b. The units used as the basis for proven field performance shall have been exposed to the same general type of environment, temperature range and traffic volume as is contemplated for the units supplied to the purchaser.

B. Subcontractor Qualifications: Subcontractor shall submit evidence of skill and not less than five (5) years specialized experience with this product.

1.05 SUBSTITUTIONS

Substitutions will be considered per Section 01 25 00 Substitution Procedures.

1.06 SUBMITTALS

A. Provide in accordance with Section 01 33 00 Submittal Procedures.

B. Manufacturer's Literature: Materials descriptive literature, installation instructions and paver color selection chart.

1. Test Reports: Three (3) copies, showing compliance with specified ASTM requirements
2. Quality Assurance Qualifications – see Item 1.04.
3. Shop drawings:
    a. Layout drawings of each paved area showing the pattern of pavers, indicate pavers requiring cutting, indicate setting bed methods in each area, drainage patterns and drains. Include details of setting beds, noting all materials and their thickness, show details at curbs and vertical surfaces.
    b. Details of custom (nonstandard) curbs and stair tread/risers, include methods of installation
4. Samples: Three (3) sample pavers of each manufacturer, type, size and color selected or specified.

1.07 PROJECT/SITE CONDITION

A. Environmental Requirements: Do no work during freezing weather or on wet or frozen sub-base.

B. Mock-up Installation

1. Prior to the start of precast concrete paver work construct mock-ups of each type of paver size and pattern area including precast curb for the Owner and Architect to review. The mock-ups will be at the project site at a location mutually agreed to by the Owner and Contractor.
2. Construct the two (2) mock-up installations a minimum 8 foot x 8 foot area of typical precast concrete units and slabs with all setting beds, joints, edge and curb details as shown on the drawings.
3. After review of the mock-ups, they should be retained and used as a standard of quality for the precast concrete paver work. At completion of the work remove the mock-up installations and related materials from the project site. If the mock-ups are incorporated in the actual construction, record their actual locations and sizes on the actual built record drawings for the project.

1.08 SEQUENCING AND SCHEDULING

Coordinate sequencing and scheduling of work with other supporting, adjacent, contiguous or otherwise related material trades.

1.09 PRODUCT HANDLING

Adhere to requirements of Section 01 66 00 Product Storage and Handling Requirements.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Basis of Design: Tectura Designs, Wausau WI, Phone: 1-800-388-8728. Website: http://www.tecturadesigns.com/products/pavers/detectable-warning-ada-pavers
B. System Name: Thinset Mortar Method - Pedestrian Installation
C. Precast Concrete Pavers
    1. Name: Detectable Warning Pavers
    2. Size: As shown on the drawings
    3. Texture: ADA-2 Truncated Dome
    4. Finish and Color: To be picked from Standard color and finish.
    5. Reference Standard:
        a. Cementitious Materials: Materials shall conform to the following applicable ASTM Specifications
            i. Portland Cement: ASTM C 150 for Portland Cement
        b. Aggregates shall conform to these ASTM specifications, except that grading requirements shall not necessarily apply:
            i. Normal Weight: ASTM C 33 for Concrete Aggregates
        c. Other constituents: Coloring pigments, integral water repellents, etc., shall be previously established as suitable for use in concrete and either shall conform to ASTM Standards where applicable, or shall be shown by test or experience not to be detrimental to the durability of the concrete.
    6. Performance Requirements:
        a. Compressive Strength: At the time of delivery to the work site, the average compressive strength shall not be less than 7,000 psi with no individual unit less than 6,500 psi per ASTM C 140.
        b. Absorption: The average shall not be greater than 5% per ASTM C140.
        c. Flexural Strength: Not less than 600 psi per ASTM 293.
        d. Load carrying capacity: Paver units shall have a tested center load capacity of 1,750 lbs.
        e. Latex Mortar Mix: A.N.S.I A-118.4
        f. Water: Clean and free of deleterious acids, alkalis or organic materials
        g. Grout: A.N.S.I. A-118.6, Grout – Latex
        h. Sealant: As specified in Section 07 90 00.
        i. Back-up: As specified in Section 07 90 00.
        j. Bond Breaker: As specified in Section 07 90 00.

2.02 MIXING

A. Latex Portland Cement Mortar setting bed: As recommended by the manufacturer.
B. Grouting Mix: Latex as recommended by manufacturer. Color as selected.
C. Rework mixes from time to time to maintain proper consistency, as recommended by manufacturer but do not add ingredients. Discard mortar that has reached its initial set.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which work of this Section will be performed.
B. Verify that specified items may be installed in accordance with the approved design.
C. Correct conditions detrimental to timely and proper completion of the Work.
D. Do not proceed until unsatisfactory conditions are corrected.
E. Beginning of installation means acceptance of conditions.

3.02 INSPECTION

A. Examine all surfaces to receive the parts of the work specified herein. Concrete slab shall not exceed 1/8” in 10’-0” from required plane. Notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected. Installation of precast concrete pavers and associated construction constitutes acceptance of the adjacent and underlying construction.
B. Installation of Mortar bed as per TCA F102 - 95. All materials used follows instructions of manufacturer for use in mortar method.
C. Install precast concrete pavers
D. Grouting of pavers in strict accordance with grout manufacturer’s directions and instructions. Latex or acrylic additives of the same manufacturer as the grout.
E. All control and expansion joints to be installed as per TCA EJ 171-94. All joint materials said to follow manufacturer’s directions and instructions.
F. Field cut precast pavers in accordance with manufacturer's recommendations for methods, equipment and precautions.

3.03 CLEANING AND PROTECTION

A. Remove and replace pavers that are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment to eliminate evidence of replacement.
B. Cleaning: Remove mortar stains and all other types of soiling from exposed paver surfaces, wash and scrub clean.
C. Provide final protection and maintain conditions in a manner acceptable to installer, which ensures paver work being without damage or deterioration at time of substantial completion.

END OF SECTION