4667 Telegraph Rd., Ventura, CA 93003

Ventura College
Administration Building Alterations
Project Manual

Date: 07/31/2025

DSA File No.: 56-C1

RRM Design Group
422 East Main St.
Ventura, CA 93001

RRM Project No.: 3425-01-ED24

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Section 01 1000
Summary

PART 1 GENERAL

1.01 PROJECT

A. Project Name: Ventura College Admin Building Alterations

B. District's Name: Ventura County Community College District

C. Architect's Name: RRM Design Group.

D. The Project consists of the alteration of a portion of an existing administration building on a community college campus. Work includes demolition of non-structural ceilings and wall framing, new non-structural wall framing, new suspended ceilings, new windows in a portion of the building, new power distribution and lighting, new split heat pump hvac system, and new finishes throughout the project area.

1.02 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on a Stipulated Price under a Competitively Bid Public Contract.

1.03 DESCRIPTION OF ALTERATIONS WORK

A. Scope of alterations work is indicated on drawings.

B. HVAC: Provide a new heat pump, refrigerant piping, indoor unit casette units. Alter existing ductwork that is demolished and existing ductwork to remain.

C. Electrical Power and Lighting: Rewire areas of alteration and provide new power receptacles. Provide new lighting in project areas.

D. Fire Alarm: Alter fire alarm system to accommodate remodeled offices.

1.04 OWNER OCCUPANCY

A. District intends to continue to occupy buildings and site facilities adjacent to the Project site during the entire construction period.

B. District intends to occupy the Project by the date stated in the Agreement as the contract completion date.

C. Cooperate with District to minimize conflict and to facilitate District's operations.

D. Schedule the Work to accommodate District occupancy.

1.05 CONTRACTOR USE OF SITE AND PREMISES

A. Arrange use of site and premises to allow:
   1. Owner occupany and access to areas adjacent to Project site..

B. Provide access to and from site as required by law and by District:
   1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
   2. Do not obstruct roadways, sidewalks, or other public ways without permit.

C. Time Restrictions:
   1. Limit conduct of especially noisy exterior work during the hours of instruction.
      a. Instruction hours: Monday thru Friday 8:50am to 3:00pm .
   2. Limit delivery of materials during times of peak traffic on site as follows:.
      a. Drop-off Monday: 9:25am to 9:45am.
      b. Drop-off Tuesday thru Friday: 8:35am to 8:55am
      c. Pick up Monday thru Friday: 2:45pm to 3:10pm

D. Utility Outages and Shutdown:
   1. There shall be no disruption of utility services during hours of Instruction without notification to and prior authorization by District.
   2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to District and authorities having jurisdiction.
   3. Limit shutdown of utility services to non-instruction hours and at a time, arranged at least 24 hours in advance with District.
   4. Prevent accidental disruption of utility services to other facilities.

E. Refer to 01 5000 Construction Facilties and Temporary Controls for additional information.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

Section 01 3300
Submittals

PART 1 - GENERAL

1.01 DESCRIPTION

A. To ensure that specified products are furnished and installed in accordance with plans and specifications, transmittal procedures have been established for submittals for review by the Construction Manager, the Architect, and the Owner.

B. Make all following submittals in strict accord with provisions of this Section and with requirements of the General Conditions:
   1. Progress Schedule.
   2. Schedule of Values
   3. Safety Plan
   4. Certificates
   5. Shop Drawings.
   6. Descriptive Data/Material Lists.
   7. Samples.
   8. Test Reports
   9. Alternatives (Substitutions).
   10. Project Record Documents

C. Electronic Data Transfer Agreement

1.02 RELATED REQUIREMENTS

A. General Conditions.

B. Section 01 3216 - Construction Progress Schedule

C. Section 01 7700 - Contract Closeout:

D. Test Reports: Pertinent Specification Sections.

E. Test Reports: Pertinent Specification Sections.

PART 2 - PRODUCTS

2.01 PROGRESS SCHEDULE

A. Prepare and submit progress schedule of procurement and fabrication activities, and component deliveries as required by Section 01 3216 and within the time of completion identified in Notice to Bidders.

2.02 SHOP DRAWINGS

A. Submittals shall be in electronic format (PDF) and include name and location of project, name of Contractor, and contract numbers and cross references to contract documents. Number shop drawings consecutively. Make drawings legible and complete in every respect. Refer to General Conditions.

B. If shop drawings show variations from Contract requirements because of standard shop practice or other reason, make specific mention of such variations in letter of transmittal, as well as on drawings, in order that (if acceptable) suitable action may be taken for proper adjustment of Contract. Unless specific changes have been noted and accepted, no deviations from Contract Documents will be permitted.

2.03 PRODUCT DATA/MATERIAL LISTS

A. Manufacturer's Standard Schematic Drawings:
   1. Modify drawings to delete information, which is not applicable to Project.
   2. Supplement standard information to provide additional information applicable to Project.

B. Manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations, and other standard descriptive data:
   1. Clearly mark each copy to identify pertinent materials, products, or models.
   2. Show dimensions and clearances required.
   3. Show performance characteristics and capacities.
   4. Show wiring diagrams and controls.
   5. Include calculations when applicable.

C. Electronic submittal of product data in pdf format, unsecured, is acceptable.

2.04 SAMPLES

A. Where required by the specifications and by change orders, the Contractor shall provide at no additional cost:
   1. Physical examples to illustrate materials, equipment or workmanship, and to establish standards by which completed work is judged.
   2. Where size of samples is not specified, office samples should be of sufficient size and quantity to clearly illustrate:
      a. Functional characteristics of product or material, with integrally related parts and attachment devices.
         1) After review, samples may be used in construction of project.

PART 3 - EXECUTION

3.01 SUBMISSION REQUIREMENTS

A. Schedule submissions at least four weeks before dates reviewed submittals will be needed. Some submissions may be required to be submitted even earlier.

B. Identification: Identify all submittals with names and location of project, name of Contractor and contract numbers.
   1. Submittals shall be accompanied by letter of transmittal addressed to Construction Manager following format and procedures established at the Preconstruction Conference.
   2. Each submittal shall be numbered by product 2-digit Specification Division and 4-digit Specification Section number and shall contain list of items submitted, properly identified as to drawing and/or page numbers.
   3. Digital submittals more than 10 pages in length shall be bookmarked or tabbed by each product component included for review in the submission for ease of reference.
   4. Submittals not adequately identified and bookmarked will be returned to Contractor for correction and resubmittal.

C. Architect will review submittals for conformance with Contract Documents and acceptance by Architect covers only such conformance. Responsibility for accuracy and correction and resubmittal shall be the Contractor's.

D. Acceptance of submittals will be general and shall not relieve Contractor from responsibility for proper fitting and construction of work, nor from furnishing materials and work required by Contract, which may not be indicated on submittals.

E. No portion of work requiring submittals that affect the construction shall be commenced until submittal has been reviewed and accepted by Architect. All such portions of work shall be in accordance with accepted submittals.

F. Number of copies required by Architect: Electronic PDF's are acceptable and preferred in lieu of hard copies. Only provide hard copies as follows if information is unable to be digitized.
   1. Schedule of Values: Two (2) copies AIA form G107 with back up sheets.
   2. Certification: Three (3) copies
   3. Samples: As specifically indicated in pertinent Specification Section.
   4. Samples for Color/Pattern Selection. Three (3) sets of manufacturer's complete range for initial selection: and additional samples as requested of selected color/pattern for inclusion in final color schedule.
   5. Alternatives: Three (3) copies of all required related data and information.

3.02 SUBMITTALS SHALL INCLUDE (WHERE APPLICABLE):

A. Date and revision dates.
   1. Project title and work order number.
   2. Names of Contractor, subcontractor and supplier or manufacturer.
   3. Identification of product or material.
   4. Relation to adjacent structure or material.
   5. Field dimensions, clearly identified as such.
   6. Specification Section number.
   7. Consecutive submittal number.
   8. Blank space for Architect's stamp and approving agency as required.
   9. Contractor's stamp, initialed or signed, certifying review of submittal, verification of field measurements and compliance with Contract Documents.

END OF SECTION

Section 01 4000
Quality Control

PART 1 - GENERAL

1.01 DEFINITIONS

A. Soils Engineer and Testing Laboratory: The District will retain a qualified soils engineer and testing laboratory to perform tests and report on work as specified in the contract documents, and as otherwise required.

B. Testing Agency: An organization other than the testing laboratory, retained and paid by the District to perform tests and report on whether or not designated items of work comply with the requirements of the contract documents.

1.02 TESTS

A. The District will select an independent testing laboratory to conduct the tests. Selection of the material required to be tested shall be by the laboratory or the District's representative and not by the Contractor.

B. The Contractor shall notify the District's representative a sufficient time in advance of the manufacture of material to be supplied by him under the contract documents, which must by terms of the Contract be tested, in order that the District may arrange for the testing of same at the source of supply.

C. Any material shipped by the Contractor from the source of supply prior to having satisfactorily passed such testing and inspection or prior to the receipt of notice from said representative that such testing and inspection will not be required shall not be incorporated in the job.

D. The District will select and pay testing laboratory costs for all tests and inspections, but may be reimbursed by the Contractor for such costs under the contract documents.

1.03 TESTING LABORATORY

A. General: Services of a testing laboratory are required for work specified in various individual specification Sections.

B. Contractor Responsibilities:
   1. Contractor shall cooperate with testing laboratory personnel.
   2. Furnish copies of product test reports as specified.
   3. Furnish incidental labor and facilities:
      a. To provide access to work to be tested
      b. To obtain and handle samples at the project site or at the source of the product to be tested as requested by the testing lab
      c. To facilitate inspections and tests

d. To facilitate storage and curing of test samples
e. To fabricate testing samples as indicated

1.04 TEST REPORTS

A. The testing laboratory will distribute reports as follows:
   1. Construction Manager (1 copy)
   2. Architect (1 copy)
   3. Applicable Consultants (1 copy each)
   4. State Agencies as appropriate
   5. District's Project Inspector

B. The Owner shall distribute reports in the same manner and number as for the testing laboratory.

1.05 RETESTING

A. The District Representative shall have the right to order additional tests as instructed if he has reasonable doubt that materials comply with Specification requirements.
   1. If additional tests establish that materials comply with Specification requirements, costs for such tests will be paid by the District.
   2. If additional tests establish that materials do not comply with Specification requirements, costs for such retests shall be paid by the Contractor.

1.06 INSPECTION BY THE DISTRICT

A. The District and Architect shall, at all times, have access for the purpose of inspection to all parts of the work and to the shops wherein the work is in preparation, and the Contractor shall at all times maintain proper facilities and provide safe access for such inspection.

B. The District and Architect shall have the right to reject materials and quality of work, which are defective, or to require their correction. Rejected work quality shall be satisfactorily corrected and rejected materials shall be removed from the premises without charge to the District. If the Contractor does not correct such rejected work within a reasonable time, fixed by written notice, the District may correct same and charge the expense to the Contractor.

C. Should it be considered necessary or advisable by the District or Architect, at any time before final acceptance of the entire work to make an examination of the work already completed by removing or tearing out the same, the Contractor shall on request promptly furnish all necessary facilities, labor and materials. If such work is found to be defective in any respect due to the fault of the Contractor or his subcontractor, he shall defray all expenses of such examinations and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the Contract, the additional cost of labor and material necessarily involved in the examination and replacement shall be allowed the Contractor.

1.07 PROJECT INSPECTOR - DISTRICT'S

A. A Project Inspector retained by the District in accordance with the requirements of the California Code of Regulations, Title 24, will be assigned to the work. His duties are specifically defined in Title 24, Part I, Sec. 4-342.

B. The work of construction in all stages of progress shall be subject to the personal continuous observation of the Project Inspector. He shall have free access to any or all parts of the work at any time. The Contractor shall furnish the Project Inspector reasonable facilities for obtaining such information as may be necessary to keep him fully informed respecting the progress and manner of the work and the character of the materials. Inspection of the work shall not relieve the Contractor from any obligation to fulfill this Contract.

PART 2 - PRODUCTS - NOT USED.

PART 3 - EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have Work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

A. Tests will be performed under provisions identified in this section and identified in the respective product specification sections.

B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

C. Accepted mock-ups shall be a comparison standard for the remaining Work.

D. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, remove mock-up and clear area when directed to do so.

3.03 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, as applicable, and to initiate instructions when necessary.
   1. Submit qualifications of observer to Architect 30 days in advance of required observations.
   2. Observer subject to approval of District.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.05 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not conforming to specified requirements.

B. If, in the opinion of Architect, it is not practical to remove and replace the Work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

Section 01 5000
Construction Facilities & Temporary Controls

PART 1 GENERAL

1.01 WORK INCLUDED

A. This Section includes requirements for construction facilities and temporary controls, including temporary utilities, support facilities, and security and protection.

B. Temporary utilities include, but are not limited to, the following:
   1. Water service and distribution.
   2. Temporary electric power and light.
   3. Sanitary facilities, including drinking water and washing facilities.
   4. Storm and sanitary sewer.

C. Support facilities include, but are not limited to, the following:
   1. Field offices and storage sheds.
   2. Temporary enclosures.
   3. Waste disposal services.
   4. Construction aids and miscellaneous services and facilities.

D. Security and protection facilities include, but are not limited to, the following:
   1. Temporary fire protection.
   2. Barricades, warning signs, and lights.
   3. Enclosure fence for the site.
   4. Environmental protection.

1.02 QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:
   1. Building code requirements.
   2. Health and safety regulations.
   3. Utility company regulations.
   4. Police, fire department, and rescue squad rules.
   5. Environmental protection regulations.

B. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.03 STANDARDS - COMPLY WITH THE FOLLOWING LISTED STANDARDS

A. NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations

B. ANSI A10 Series standards for "Safety Requirements for Construction and Demolition

C. NECA Electrical Design Library "Temporary Electrical Facilities

D. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 "National Electric Code."

E. NFPA 10 "Standard for Portable Fire Extinguishers"

F. NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations."

1.04 SUBMITTALS

A. Construction Site Plan: Provide plan showing proposed locations of temporary site constructions including temporary utilities, construction facilities, construction fencing and gates, and laydown areas.

1.05 PROJECT CONDITIONS

A. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.

PART 2 PRODUCTS

2.01 MATERIALS

A. General: Provide new materials. If acceptable to the Architect, the Contractor may use undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended.

B. Open-Mesh Fencing: Provide 0.120-inch- (3-mm-) thick, galvanized 2-inch (50-mm) chain link fabric fencing 6 feet (2 m) high and galvanized steel pipe posts, 1-1/2 inches (38 mm) I.D. for line posts and 2-1/2 inches (64 mm) I.D. for corner posts.

2.02 EQUIPMENT

A. General: Provide new equipment. If acceptable to the Architect, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.

B. Water Hoses: Provide 3/4-inch (19-mm), heavy-duty, abrasion-resistant, flexible rubber hoses 100 feet (30 m) long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.

C. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of

electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.

D. Temporary Offices: Provide prefabricated or mobile units or similar job-built construction with lockable entrances, operable windows, and serviceable finishes. Provide heated and air-conditioned units on foundations adequate for normal loading.

E. Temporary Toilet Units: Provide self-contained, single-occupant toilet units of the chemical type. Provide units properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material. Provide self contained washing facilities, stocked with soap, disposable towels, and drinking cups; Use only potable water in Health Dept. approved containers.

F. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for the exposures.
   1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

PART 3 EXECUTION

3.01 INSTALLATION

A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.02 TEMPORARY UTILITY INSTALLATION

A. General: As required to complete the work of the contract, engage the appropriate local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.
   1. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.
   2. Obtain easements to bring temporary utilities to the site where the District's easements cannot be used for that purpose.
   3. Use Charges: Cost or use charges for temporary facilities are not chargeable to the District or Architect. Neither the District nor Architect will accept cost or use charges as a basis of claims for Change Orders.

B. Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period.

Include meters, transformers, overload-protected disconnects, automatic ground-fault interrupters, and main distribution switchgear.

1. Install electric power service underground, except where overhead service must be used.
2. Power Distribution System: Install wiring overhead and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 Volts, ac 20 Ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.

C. Sanitary facilities include temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for the type, number, location, operation, and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs. Maintain service until District allows use of permanent facilities.

1. Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Provide covered waste containers for used material.

D. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a healthy and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition.

3.03 SUPPORT FACILITIES INSTALLATION

A. Locate field offices, storage sheds, and other temporary construction and support facilities for easy access.

1. Maintain support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.

B. Field Offices: Provide insulated, weathertight temporary offices of sufficient size to accommodate required office personnel at the Project Site. Furnish and equip offices as follows:

1. Furnish with plan layout table and storage space for project documents and submittals.

C. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.

D. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg F (27 deg C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material lawfully.

3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer, as requested by the Architect.

B. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations."
   1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.
   2. Store combustible materials in containers in fire-safe locations.
   3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in hazardous fire-exposure areas.
   4. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.

C. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting, including flashing red or amber lights.

D. Enclosure Fence: Before excavation begins, install a minimum six foot tall enclosure fence with lockable entrance gates. Locate where indicated, or enclose the entire site or the portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering the site, except by the entrance gates.

E. Provide open-mesh, chainlink fencing with posts set in a compacted mixture of gravel and earth or portable fencing, if appropriate, with sufficient hold down weight to prevent overturning. Portable fence post bases shall not extend into adjacent walkways.

F. Provide visual screening of the construction site from specific areas if required by District.

G. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

H. Storage: Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.

I. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons or firms near the site.

J. Storm Water Protection: Provide rumble strips, straw waddles, silt fences or other measures as required to provide protection of storm water. Comply with all regulations for the protection of storm water resources.

3.05 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
   1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
   2. Maintain site as described in Section 01 7420 Cleaning, including sweeping up dirt and debris blown or tracked off site.

C. Termination and Removal: Unless the Architect requests that it be maintained longer, remove each temporary facility when the need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
   1. Materials and facilities that constitute temporary facilities are the Contractor's property. The Owner reserves the right to take possession of project identification signs.
   2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at the temporary entrances, as required by the governing authority.
   3. At Substantial Completion, clean and renovate permanent facilities used during the construction period including, but not limited to, the following:

END OF SECTION

Section 01 6000
Product Requirements

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Transportation, handling, storage and protection.

C. Substitution limitations.

D. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Product quality monitoring.

B. Section 01 7419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.

B. Unforeseen historic items encountered remain the property of the District; notify District promptly upon discovery; protect, remove, handle, and store as directed by District.

C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the District, or otherwise indicated as to remain the property of the District, become the property of the Contractor; remove from site.

2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by Contract Documents.

B. Use of products having any of the following characteristics is not permitted:
   1. Made using or containing asbestos

C. Where other criteria are met, Contractor shall give preference to products that:
   1. Have longer documented life span under normal use.

2. Result in less construction waste. See Section 01 7419

2.03 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.02 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 7419.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

G. Comply with manufacturer's warranty conditions, if any.

H. Do not store products directly on the ground.

I. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

J. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

K. Prevent contact with material that may cause corrosion, discoloration, or staining.

L. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

M. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

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Section 01 7329
Cutting and Patching

PART I - GENERAL

1.01 SECTION INCLUDES

A. Procedures for cutting and patching as may be required to complete the work of this project.

1.02 RELATED SECTIONS

A. Section 01 5000 - Construction Facilities and Temporary Controls

B. Section 01 7135 - Restoration of Improvements

C. Section 01 7420 - Cleaning

D. Section 01 7419 - Construction Waste Management & Disposal

E. Section 320505 - Selective Demolition for Exterior Improvements

1.03 DEFINITONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.04 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load carrying capacity or load-deflection ratio.

B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

C. Miscellaneous Elements: Do not cut or patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

D. Visual Requirements: Do not cut or patch in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities.

Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
   1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
   1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
   2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

3.03 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
   1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original installer, comply with original installer's written recommendations.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Proceed with patching after construction operations requiring cutting are complete.
   3. When possible, cut along existing control joints and score lines.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
   1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
   2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
      a. Clean, piping, conduit, and similar features before applying paint or other finishing materials.
      b. Restore damaged pipe covering to its original condition.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION

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Section 01 7419
Construction Waste Management and Disposal

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

A. District requires that this project generate the least amount of trash and waste possible with the goal of diverting 65% of waste from the landfill.

B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

D. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:
   1. Aluminum and plastic beverage containers.
   2. Corrugated cardboard.
   3. Wood pallets.
   4. Clean dimensional wood.
   5. Land clearing debris, including brush, branches, logs, and stumps; see Section 31 1000 - Site Clearing for use options.
   6. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
   7. Carpet, carpet cushion, carpet tile, and carpet remnants, both new and removed: DuPont (http://flooring.dupont.com) and Interface (www.interfaceinc.com) conduct reclamation programs.

E. Contractor Reporting Responsibilities: Submit periodic Waste Disposal Reports; report landfill disposal, incineration, recycling, salvage, and reuse regardless of to whom the cost or savings accrues; use the same units of measure on required reports.

F. Develop and follow a Waste Management Plan designed to implement these requirements.

G. Methods of trash/waste disposal that are not acceptable are:
   1. Burning on the project site.
   2. Burying on the project site.
   3. Dumping or burying on other property, public or private.
   4. Other illegal dumping or burying.

H. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 RELATED REQUIREMENTS

A. Section 01 3300 - Submittals: Additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. Section 01 5000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.

C. Section 01 6000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.

D. Section 01 7329 - Cutting and Patching: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

E. Section 31 1000 - Site Clearing: Handling and disposal of land clearing debris.

1.03 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

I. Return: To give back reusable items or unused products to vendors for credit.

J. Reuse: To reuse a construction waste material in some manner on the project site.

K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

N. Toxic: Poisonous to humans either immediately or after a long period of exposure.

O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.04 SUBMITTALS

A. Submit Waste Management Plan within 10 calendar days after receipt of Notice of Award of Bid, or prior to any trash or waste removal, whichever occurs sooner; submit projection of all trash and waste that will require disposal and alternatives to landfilling.

B. Waste Management Plan: Include the following information:
   1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
   2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
   3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
   4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
   5. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
   6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.

C. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
   1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
   2. Submit Report on a form acceptable to District.
   3. Landfill Disposal: Include the following information:
      a. Identification of material.
      b. Amount, in tons or cubic yards, of trash/waste material from the project disposed of in landfills.
      c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.

d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.

4. Recycled and Salvaged Materials: Include the following information for each:
   a. Identification of material, including those retrieved by installer for use on other projects.
   b. Amount, in tons or cubic yards, date removed from the project site, and receiving party.
   c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
   d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
   e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
5. Material Reused on Project: Include the following information for each:
   a. Identification of material and how it was used in the project.
   b. Amount, in tons or cubic yards.
   c. Include weight tickets as evidence of quantity.
6. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

A. Waste management and diversion goals may be achieved by the following methods:
   1. Roll Off Waste Container: Contractor may hire a company which provides a roll off waste container which is then sorted off site.
   2. On Site Sorting: Contractor to sort waste on site.

3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, District, and Architect.

C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

D. Meetings: Discuss trash/waste management goals and issues at project meetings.
   1. Prebid meeting.
   2. Preconstruction meeting.
   3. Regular job-site meetings.

E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
   1. Provide containers as required.
   2. Provide adequate space for pick-up and delivery and convenience to subcontractors.
   3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

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Section 01 7420
Cleaning

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Cleaning throughout the construction period, and final project cleaning prior to the acceptance tour.

1.02 RELATED SECTIONS

A. Section 01 5000 - Construction Facilities and Temporary Controls

1.03 QUALITY ASSURANCE

A. Inspection: Conduct daily inspection, and more often if necessary, to verify that requirements of cleanliness are being met.

B. Codes and Standards: In addition to the requirements specified herein, comply with pertinent requirements of authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 CLEANING MATERIALS AND EQUIPMENT

A. Provide required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.

2.02 COMPATIBILITY

A. Use cleaning materials and equipment that are compatible with the surfaces being cleaned, as recommended by the manufacturer of the material to be cleaned.

PART 3 - EXECUTION

3.01 PROGRESS CLEANING

A. General:
   1. Retain stored items in an orderly arrangement allowing maximum access, not impeding drainage or traffic, and providing the required protection of materials.
   2. Do not allow the accumulation of scrap, debris, waste material, and other items not required for construction of this work. Debris shall be removed from the site and disposed

of in a lawful manner. Disposal receipts or dump tickets shall be furnished to Architect upon request.

3. At least twice each month, and more often if necessary, remove scrap debris, and waste material from the job site.
4. Provide adequate storage for items awaiting removal from the job site, observing requirements for fire protection and protection of the ecology.

B. Site:
1. Daily, and more often if necessary, inspect the site and pick up all scrap, debris, and waste material. Remove items to the place designated for their storage. Flammable waste shall be kept in sealed metal containers until removed from the site.
2. Weekly, and more often if necessary, inspect, arrangements of materials stored on the site; restack, tidy, or otherwise service arrangements to meet the requirements specified above.
3. Maintain the site in a neat and orderly condition.

C. Structures:
1. Weekly, and more often if necessary, inspect the structures and pick up scrap, debris, and waste material. Remove items to the place designated for their storage.
2. Weekly, and more often if necessary, sweep interior spaces clean.
   a. "Clean", for the purpose of this subparagraph, shall be interpreted as meaning free from dust and other material capable of being removed by use of reasonable effort and a handheld broom, i.e., "broom-clean".
3. As required preparatory to installation of succeeding materials, clean the structures of pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using equipment and materials required to achieve the required cleanliness.
4. Following the installation of finish floor materials, clean the finish floor daily, and more often if necessary, and while work is being performed in the space in which finish materials have been installed.
   a. "Clean", for the purpose of this subparagraph, shall be interpreted as meaning free from foreign material that, in the opinion of the Architect, may be injurious to the finish floor material, i.e., "vacuum-clean".

D. General: The General Conditions require general cleaning during construction. Prior to completion of the work, remove from the job site all tools, surplus materials, equipment, scrap, debris, and waste, conduct final progress cleaning as described below.

E. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions. Unless otherwise specifically directed by the Architect, water and broom clean paved areas on the site and public paved areas directly adjacent to the site. Remove resultant debris

F. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion.
1. Remove labels that are not permanent labels.

2. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.

G. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition. Leave concrete floors broom clean. Vacuum carpeted surfaces. Sweep and mop vinyl and rubber surfaces.

H. Structures:
1. Exterior: In areas affected by the work under this contract, visually inspect exterior surfaces and remove traces of soil, waste material, smudges, and other foreign matter. Remove traces of splashed material from adjacent surfaces. If necessary to achieve a uniform degree of exterior cleanliness, hose down the exterior of the structure.
2. In the event of stubborn stains not removable with water, the Architect may require light sandblasting or other cleaning at no additional cost to the District.

I. Interior: In areas affected by the work under this contract, visually inspect interior surfaces and remove traces of soil waste material, smudges, and other foreign matter. Remove traces of splashed materials from adjacent surfaces. Remove paint drippings, spots, stains, and dirt from finished surfaces. Use only the cleaning materials and equipment instructed by the manufacturer of the surface material.

J. Glass: Clean glass inside and outside.

K. Polished surfaces: On surfaces requiring the routine application of buffed polish, apply the polish recommended by the manufacturer of the material being polished. Glossy surfaces shall be cleaned and shined as intended by the manufacturer
1. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
2. Clean the site, including landscape development areas, of rubbish, litter, and other foreign substances. Sweep paved areas broom clean; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted to a smooth, even-textured surface.

L. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid the Project of rodents, insects, and other pests.

M. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.

N. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the District's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of lawfully.

O. Extra Materials: Where extra materials of value remain after completion of associated Work, they become the District's property. Dispose of these materials as directed by the Owner.

P. Timing: Schedule final cleaning as accepted by the Architect to enable the District to accept a completely clean project.

Q. Cleaning During District's Occupancy
1. Should the District occupy the work or any portion thereof prior to its completion by the Contractor and acceptance by the District, responsibilities for interim and final cleaning of the occupied spaces shall be determined by the Architect in accordance with the General Conditions of the Contract.

END OF SECTION

Section 02 4100
Demolition

<<<< UPDATE NOTES

PART 1 GENERAL

2.01 SECTION INCLUDES

A. Building demolition excluding removal of hazardous materials and toxic substances.

B. Selective demolition of built site elements.

C. Abandonment and removal of existing utilities and utility structures.

2.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on Contractor's use of site and premises.

B. Section 01 1000 - Summary: Description of items to be salvaged or removed for re-use by Contractor.

C. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

D. Section 01 5713 - Temporary Erosion and Sediment Control.

E. Section 01 6000 - Product Requirements: Handling and storage of items removed for salvage and relocation.

F. Section 01 7419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

G. Section 31 1000 - Site Clearing: Vegetation and existing debris removal; earth stripping and stockpiling.

H. Section 31 2200 - Grading: Rough and fine grading.

I. Section 31 2323 - Fill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

2.03 SUBMITTALS

A. See Section 01 3300 - Submittals for submittal procedures.

B. Site Plan: Indicate:

1. Areas for temporary construction and field offices.

C. Demolition Plan: Submit demolition plan as required by OSHA and local AHJs.
   1. Indicate extent of demolition, removal sequencing, bracing and shoring, and location and construction of barricades and fences.
   2. Demolition firm qualifications.

D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

PART 2 PRODUCTS

3.01 MATERIALS

A. Fill Material: See Section 31 2323.

PART 3 EXECUTION

4.01 DEMOLITION

A. Remove the entire building designated on the Drawings..

B. Remove paving and curbs required to accomplish new work.

C. Within area of new construction, remove foundation walls and footings in their entirety or as indicated on the Drawings.

D. Outside area of new construction, remove foundation walls and footings to a minimum of 2 feet below finished grade or as needed to implement new construction.

E. Remove fences and gates.

F. Remove other items indicated, for salvage, relocation, and recycling.

G. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in Section 31 2200.

4.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
   3. Provide, erect, and maintain temporary barriers and security devices.

4. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
5. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
6. Conduct operations to minimize obstruction of public and private entrances and exits. Do not obstruct required exits at any time. Protect persons using entrances and exits from removal operations.
7. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon, or limit access to their property.

B. Do not begin removal until receipt of notification to proceed from District.

C. Protect existing structures and other elements to remain in place and not removed.
1. Provide bracing and shoring.
2. Prevent movement or settlement of adjacent structures.
3. Stop work immediately if adjacent structures appear to be in danger.

D. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

4.03 EXISTING UTILITIES

A. Coordinate work with utility companies. Notify utilities before starting work, comply with their requirements, and obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to District.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to District.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

4.04 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

Section 07 2100
Board and Batt Insulation

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Thermal batt insulation in exterior wall, ceiling, and roof construction.

B. Thermal batt insulation at low slope (Flat) roof areas.

C. Sound insulation at all interior demising walls not otherwise thermally insulated - size to fill void 3 5/8" min.

D. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.02 RELATED REQUIREMENTS

A. Section 09 5100 - Acoustical Ceilings

1.03 DEFINITIONS

A. Mineral Fiber Material Composition: Insulation referred to as mineral fiber block, board, and blanket insulation is composed of fibers from mineral based substances such as rock, slag, or glass and processed from the molten state into fibrous form.
   1. Based on type of insulation substance, the material will be referred to as a mineral fiber when having a rock or slag base, and glass fiber with a glass or silica sand base, also considered a mineral.
   2. Insulation blankets are flexible units consisting of felted, bonded, or unbonded fibers formed into rolls or flat cut pieces referred to as batts; rolls are simply longer versions of batts.
   3. For additional information about mineral fiber and the various classification types, refer to the following reference standards; ASTM C553, ASTM C612, ASTM C665, and ASTM C726.

1.04 QUALITY ASSURANCE

A. Installer - Work to be performed only by workers thoroughly skilled and specially trained in the techniques of insulation, and who are completely familiar with the published recommendations of the manufacturer of the material being used. Installer to take care that facing material of batt insulation is not torn or punctured.

B. Materials of this section shall provide continuity of thermal barrier at building enclosure elements.

1.05 REFERENCE STANDARDS

A. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2024.

B. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2024.

D. ASTM C726 - Standard Specification for Mineral Wool Roof Insulation Board; 2024.

E. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

F. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2024c.

1.06 SUBMITTALS

A. See Section 01 3300 - Submittals for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.07 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

1.08 PRODUCT HANDLING

A. Protection
   1. Insulating materials to be stored at the job site in a safe, dry place with all labels intact and legible at time of installation.
   2. Comply with manufacturer's recommendations for handling, storage and protection during installation. Use all means to protect insulating materials before, during, and after installation. Do not allow products to become wet, damp, or punctured.

B. Replacements - In the event of damage, including water intrusion, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Insulation in Metal Framed Walls: Batt insulation with no vapor retarder.

B. Insulation in Wood Framed Walls: Batt insulation with no vapor retarder.

C. Insulation in Wood Framed Ceiling Structure: Batt insulation with no vapor retarder.

2.02 MINERAL FIBER BLANKET INSULATION MATERIALS

A. Batt Insulation: ASTM C 665; preformed glass fiber batt; friction fit, conforming to the following:
   1. Surface Burning Characteristics: Flame spread index of 25 or less; smoke developed index of 50 or less, when tested in accordance with ASTM E 84.
   2. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
   3. Formaldehyde Content: Zero.
   4. Thermal Resistance: (Unless otherwise noted on plans with an increase value)
      a. At Flat Roof Areas: R-30 unfaced batts
      b. At Exterior Walls: R-20 unfaced Batts.
      c. Interior Wall Sound Insulation: fiberglass sound control batts thickness to fill wall cavity
   5. Facing: Aluminum foil, flame spread 25 rated; one side.
   6. Products:
      a. CertainTeed Corporation: www.certainteed.com.
      b. Johns Manville: www.jm.com.
      c. Knauf Insulation; Performance+ EcoBatt Insulation: www.knaufinsulation.com/#sle.
      d. Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation: www.owenscorning.com/en-us/#sle.
      e. Owens Corning Corp: www.owenscorning.com.
   7. Substitutions: See Section 01 6000 - Product Requirements.

2.03 ACCESSORIES

A. Provide all other materials and products necessary for the proper completion of the work.

B. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

C. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where installation can properly begin.

D. Verify that specified products may be installed in accordance with the original design and the manufacturer's recommendations.

3.02 BATT INSTALLATION

A. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.

B. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

C. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

3.03 ACOUSTIC BATT INSTALLATION

A. Install acoustic batt insulation at interior walls, both existing and new, where studs are exposed or newly constructed.

3.04 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

End of Section

Section 07 2500
Weather Barriers

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water-resistive barriers.

1.02 RELATED REQUIREMENTS

A. Section 07 6200 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with weather barriers.

B. Section 07 9005 - Joint Sealers: Sealant materials and installation techniques.

1.03 DEFINITIONS

A. Water-Resistive Barriers: Materials or assemblies installed behind exterior wall coverings; designed to prevent liquid water from further penetration into exterior wall assembly.

1.04 REFERENCE STANDARDS

A. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

B. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers; 2016, with Editorial Revision (2021).

1.05 SUBMITTALS

A. Product Data: Provide data on material characteristics and performance criteria.

1.06 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

1.07 WARRANTY

A. Installed product to be covered by a 10 year product and labor warranty.

B. Contractor shall provide a job site checklist and observation report generated by a manufacturer's representative.

PART 2 PRODUCTS

2.01 WEATHER BARRIER ASSEMBLIES

A. Water-Resistive Barrier: Provide on exterior walls under exterior cladding.

2.02 WATER-RESISTIVE BARRIERS

A. Description: Materials installed behind exterior wall coverings; designed to prevent liquid water from further penetration into exterior wall assembly. Primary materials include mechanically applied sheets; accessory materials include flashings and seam tapes.

B. Building Paper: Asphalt-saturated kraft Grade D type sheathing paper complying with ICC-ES AC38.
   1. Water Vapor Permeance: 29 perms, minimum, when tested in accordance with ASTM E96/E96M using Procedure A - Desiccant Method, at 73.4 degrees F.

2.03 ACCESSORIES

A. All accessories used in weather barrier system shall by produced by a single manufacturer or shall be approved by the manufacturer for use with their system.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions comply with requirements of this section.

3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's installation instructions.

B. Mechanically Fastened Sheets:
   1. Install sheets in shingle fashion to shed water; align horizontally.
   2. Overlap seams as recommended by manufacturer, 6 inches, minimum.
   3. Overlap at outside and inside corners as recommended by manufacturer, 12 inches, minimum.
   4. Install water-resistive barrier over jamb flashings.
   5. Install air barrier and vapor retarder underneath the jamb flashings.
   6. Install head flashings under water-resistive barrier.
   7. At framed openings with frames having nailing flanges, extend sheet into opening and over flanges; at head of opening, seal sheet over flange and flashing.

C. Openings and Penetrations in Exterior Water-Resistive Barriers:
   1. Install flashing over sills, covering entire sill framing member, and extend at least 5 inches onto water-resistive barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
   2. At openings filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
   3. At openings filled with nonflanged frames, seal water-resistive barrier to each side of framing at opening using flashing at least 9 inches wide, and covering entire depth of framing.
   4. At head of openings, install flashing under water-resistive barrier extending at least 2 inches beyond face of jambs; seal water-resistive barrier to flashing.
   5. At interior face of openings, seal gaps between window and door frames and rough framing using appropriate joint sealant over backer rod.
   6. Service and Other Penetrations: Form flashing around penetrating items and seal to surface of water-resistive barrier.

3.04 FIELD QUALITY CONTROL

A. District's Inspection and Testing: Cooperate with District's testing agency.
   1. Allow access to work areas and staging.
   2. Notify District's testing agency in writing of schedule for work of this section to allow sufficient time for testing and inspection.
   3. Do not cover work of this section until testing and inspection is accepted.

B. Do not cover installed water-resistive barriers until required inspections have been completed.

C. Obtain approval of installation procedures from water-resistive barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.

D. Take digital photographs of each portion of installation prior to covering up weather barriers.

3.05 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

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Section 07 5419
Polyvinyl-Chloride Roofing - Sika Sarnafil

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Adhered polyvinyl-chloride (PVC) single-ply membrane roofing, over existing substrate.

B. Flashings.

C. Walkway protection.

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; 2023.

B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

C. ASTM D751 - Standard Test Methods for Coated Fabrics; 2019.

D. ASTM D4434/D4434M - Standard Specification for Poly(Vinyl Chloride) Sheet Roofing; 2021.

E. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2024.

F. NRCA (RM) - The NRCA Roofing Manual; 2023.

G. NRCA (WM) - The NRCA Waterproofing Manual; 2021.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.
   1. Review preparation, installation procedures, coordinating, and scheduling required with related work.

1.04 SUBMITTALS

A. See Section 01 3300 - Submittals for submittal procedures.

B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, and fasteners.

C. Installer's qualification statement.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of this section with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact.

B. Store materials in weather protected environment, clear of ground and moisture.

C. Ensure storage and staging of materials do not exceed static and dynamic load-bearing capacities of roof decking.

D. Protect foam insulation from direct exposure to sunlight.

1.07 FIELD CONDITIONS

A. Do not apply roofing membrane during unsuitable weather.

B. Do not apply roofing membrane when ambient temperature is below 40 degrees F or above 100 degrees F.

C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

E. Schedule applications so that no partially completed sections of roof are left exposed at end of the day.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sika Sarnafil & Sika Corporation - Roofing.
   1. Address: 100 Dan Road, Canton, MA 02021.
   2. Telephone: (800) 451-2504 & Sales (866) 255-3738.
   3. Website: usa.sika.com/sarnafil/#sle.

2.02 APPLICATIONS

A. Polyvinyl-Chloride (PVC) Single-Ply Membrane Roofing:

2.03 MEMBRANE ROOFING SYSTEMS

A. Polyvinyl-Chloride (PVC) Adhered Roofing Systems:
   1. Sika Sarnafil Inc; Sarnafil G 410-20.
   2. Substitutions: Not permitted.

2.04 PERFORMANCE REQUIREMENTS

A. Thermoplastic Polyvinyl-Chloride (PVC) Roofing Membrane: Single-ply, fully-adhered membrane over insulation with vapor retarder and cover boards as indicated on drawings.

B. Roofing Membrane Materials:
   1. Polyvinyl Chloride (PVC): Comply with ASTM D4434/D4434M, Type II for Sarnafil G fiberglass-reinforced adhered membranes.
      a. Thickness: 80 mil, 0.080 inch, minimum, in accordance with ASTM D751 test method.
   2. Sheet Width: As selected by Architect.
   3. Color: White.

2.05 FLASHING

A. Wall/Curb Flashing: PVC membrane flashings.
   1. Products:
      a. Sika Sarnafil Inc; Sarnafil G 410.
      b. Sika Sarnafil Inc; Sarnafil G 410 SA Flashing Membrane.
      c. Sika Sarnafil Inc; Sarnafil G 459 Flashing Membrane.
      d. Sika Sarnafil Inc; Detail Membrane PVC.

B. Sheet Metal Flashing: PVC-coated, heat-weldable sheet metal for use as perimeter edge, wall, or curb flashing.
   1. Metal Sheet: Galvanized steel complying with ASTM A653/A653M, with G90/Z275 zinc coating and at least 24-gauge, 0.0239-inch thick base metal, and 20 mil, 0.020 inch thick PVC coating laminated on one side.
   2. Products:
      a. Sika Sarnafil Inc; Sarnaclad.

C. Miscellaneous Flashing:
   1. Circles: Injection-molded, non-reinforced, prefabricated circle, 60 mil, 0.060 inch thick, and 4-1/2 inches in diameter.
      a. Color: As selected by Architect.
      b. Products:
         1) Sika Sarnafil Inc; Sarnacircles.
   2. Stack/Pipe Boot: Made from Sarnafil G 410 roofing membrane, prefabricated stack/pipe boot, 60 mil, 0.060 inch thick, and used to flash pipes, vent stacks, and cylindrical penetrations when Sarnastack Universal will not fit.
      a. Color: As selected by Architect.
      b. Penetration Diameter: 3/4 to 3 inches.
      c. Products:

3. Stack/Pipe Boot: Made from Sarnafil G 410 roofing membrane, prefabricated boot that is open along one side, 60 mil, 0.060 inch thick, and used to flash rooftop conduits and pipe penetrations when access is obstructed.
   a. Color: As selected by Architect.
   b. Penetration Diameter: As indicated on drawings.
   c. Base Diameter: As indicated on drawings.
   d. Products:

D. Flashing Adhesives:
   1. Solvent-based reactivating adhesive used to attach membrane to flashing substrate.
      a. Volatile Organic Compound (VOC) Content: 92.7 fl oz/gal.
      b. Products:
         1) Sika Sarnafil Inc; Sarnacol-2170 Adhesive.
   2. Low VOC, solvent-based reactivating adhesive used to attach membrane to flashing substrate.
      a. Volatile Organic Compound (VOC) Content: 0 fl oz/gal with EPA exemptions, and 46.5 fl oz/gal without EPA exemptions. Check local jurisdiction for VOC compliance.
      b. Products:
         1) Sika Sarnafil Inc; Sarnacol-2170 VC Adhesive.
   3. Low VOC, solvent-based, spray-applied canister flashing membrane adhesive used to attach PVC flashing membrane to approved substrates.
      a. Volatile Organic Compound (VOC) Content: 12.8 fl oz/gal with EPA exemptions, and 25.5 fl oz/gal without EPA exemptions. Check local jurisdiction for VOC compliance.
      b. Products:
         1) Sika Sarnafil Inc; Sarnacol-2175 Canister Flashing Adhesive.

2.06 ACCESSORIES

A. Cant and Edge Strips: Wood fiberboard, compatible with roofing materials; cants formed to 45 degree angle.

B. Fasteners and Anchors: Provide fasteners, anchors, nails, straps, and bars that are post-galvanized steel, aluminum, or stainless steel.
   1. Assemble mixed metal type components in an appropriate way that will avoid galvanic corrosion.

C. Polyurethane Joint Sealant/Adhesive: Moisture-cured, single-component, polyurethane-based, nonsag elastomeric sealant used in wall, curb, and drain terminations, and also used at pipe penetrations and under certain metal flashings; may be used as a pourable sealer pocket filler.
   1. Joint Depth: 1/2 inch, maximum.
   2. Complying with ASTM C920, Type S, Grade NS, Class 35, uses T, NT, O, M, G, I, and A.
   3. Products:
      a. Sika Sarnafil Inc; Sikaflex-1A.

D. Silicone Joint Sealant/Adhesive: Neutral-cure, single-component, nonsag, elastomeric silicone sealant/adhesive used in wall, curb and drain terminations, and also used at pipe penetrations and under certain metal flashings; may be used as a pourable sealer pocket filler.
   1. Color: Translucent.
   2. Complying with ASTM C920, Type S, Grade NS, Class 25, uses T, NT, O, M, G, and A.
   3. Products:

E. Mastic: Cold applied, fiber reinforced, high strength SBS modified bitumen mastic, formulated to detail around penetrations and flashings where vapor retarders and ply sheets are used.
   1. Products:
      a. Sika Sarnafil Inc; Mastic TG.

F. Seam Overlap Cleaner: Used to clean adhesive out of PVC roofing membrane seams, and is not to be used as a general membrane cleaner; also used to clean metal and to reactivate existing liquid flashing before applying new coating of liquid flashing.
   1. Products:
      a. Sika Sarnafil Inc; Seam Cleaner.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive this work.

B. Verify that roof deck and existing roof construction are structurally sound and able to provide proper support for new roofing system.

C. Verify roof deck surfaces are clean and smooth, flat, free of flaws, depressions, sharp edges, loose and foreign material, waves, projections, properly sloped, and suitable for installation of roof system.

D. Verify roof deck surfaces are dry and free of snow or ice, oil, grease, and other contaminants.

E. Verify that roof deck openings, curbs, and penetrations through roof decking such as drains and scuppers are solidly set, and cant strips, nailing strips, and reglets are properly placed.

3.02 PREPARATION

A. Owner's representative to verify that roof deck is properly secured to structural framing in accordance with local building code, and capable of resisting anticipated loads to that location.

3.03 INSTALLATION

A. Perform work in accordance with manufacturer's instructions, NRCA (RM), and NRCA (WM) applicable requirements.

B. Do not apply roofing membrane during cold or wet weather conditions.

C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.

D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

F. Coordinate this work with installation of associated counterflashings installed by others as this work proceeds.

G. Membrane:
   1. At intersections with vertical surfaces:
      a. Extend membrane over cant strips and up a minimum of 4 inches onto vertical surfaces.
      b. Fully adhere flexible flashing over membrane and up to nailing strips.
      c. Secure flashing to nailing strips at 4 inches on center.
      d. Insert flashing into reglets and secure.

H. Flashing: Install flashings concurrently with roof membrane; temporary flashings are not allowed without the prior written approval of District's Representative and manufacturer.

3.04 CLEANING

A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.

B. Remove bituminous markings from finished surfaces.

C. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.

D. Repair or replace defaced or damaged finishes caused by work of this section.

3.05 PROTECTION

A. Protect installed roofing and flashings from construction operations.

B. Where traffic must continue over the finished roof membrane, protect surfaces using durable materials.

END OF SECTION

Section 07 6200
Sheet Metal Flashing and Trim

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, gutters, downspouts, and exterior penetrations.

B. Sealants for joints within sheet metal fabrications.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

D. ASTM B32 - Standard Specification for Solder Metal; 2020.

E. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

F. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

G. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

H. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

I. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2018).

J. CDA A4050 - Copper in Architecture - Handbook; current edition.

K. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 SUBMITTALS

A. See Section 01 3300 - Submittals for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 5 years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sheet Metal Flashing and Trim:
1. ATAS International, Inc. : atas.com
2. Petersen Aluminum Corporation: www.pac-clad.com
3. Berridge Manufacturing Co.: berridge.com

B. Exterior Penetration Flashing Panel:
1. Quickflash Weatherproofing Products, Inc: www.quickflashproducts.com
2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SHEET MATERIALS

A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24-gauge, 0.0239-inch thick base metal.

B. Pre-Finished Aluminum: ASTM B209/B209M, 3005 alloy, H12 or H14 temper; 18 gauge, 0.040 inch thick; plain finish shop pre-coated with silicone modified polyester coating.
1. Silicone Modified Polyester Coating: Pigmented organic powder coating, AAMA 2603; baked enamel finish system.
2. Fluoropolymer Coating: High performance organic powder coating, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system.
3. Color: As selected by Architect from manufacturer's full colors.

C. Note: Flashing directly contacting the thermoplastic roof membrane is to be flashed with clad metal by the roofing manufacture.

2.03 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch; miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18-inch long legs; seam for rigidity, seal with sealant.

F. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

G. Fabricate flashings to allow toe to extend 2 inches over roofing . Return and brake edges.

2.04 GUTTER FABRICATION

A. Gutters: SMACNA (ASMM) Rectangular profile.

B. Accessories: Profiled to suit gutters and downspouts.
   1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
   2. Gutter Supports: Brackets.im think
   3. Downspout Supports: Brackets.

C. Downspout Boots: Plastic.

D. Seal metal joints.

2.05 EXTERIOR PENETRATION FLASHING PANELS

A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.

2.06 ACCESSORIES

A. Fasteners: Galvanized steel, with soft neoprene washers.

B. Primer Type: Zinc chromate.

C. Concealed Sealants: Non-curing butyl sealant.

D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

E. Asphalt Roof Cement: ASTM D4586/D4586M, Type I, asbestos-free.

F. Screens: Tightly fitted screens to prevent the accumulation of leaves and debris in the gutter in accordance with CBC 705A.4

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

C. In the event of a discrepancy, immediately notify the Architect.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch.

3.03 INSTALLATION

A. Gutters and exposed flashings to be prefinished aluminum.

B. Galvanized sheet metal flashings are only to be used in locations not exposed to view, such as pan flashings at windows.

C. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..

D. Apply plastic cement compound between metal flashings and felt flashings.

E. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

F. Secure gutters and downspouts in place with concealed fasteners.

END OF SECTION

Section 07 6500
Flexible Flashing

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flexible flashing system around window, door, and other openings and penetrations in walls.

1.02 RELATED REQUIREMENTS

A. Section 07 2100 - Board and Batt Insulation: Insulation used for protective cover.

B. Section 07 2500 - Weather Barriers

C. Section 07 6200 - Sheet Metal Flashing and Trim: Metal parapet, coping, and counterflashing.

D. Section 07 9200 - Joint Sealants: Sealing moving joints in waterproofed surfaces that are not required to be treated in this section.

1.03 REFERENCE STANDARDS

A. ASTM C510 - Standard Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants; 2016.

B. ASTM C719 - Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement; 2013.

C. ASTM C793 - Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants; 2005 (Reapproved 2010).

D. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).

E. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).

F. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 2022.

G. ASTM D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers; 2000 (Reapproved 2020).

H. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact; 2020.

I. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.

J. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).

K. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

L. NRCA ML104 - The NRCA Roofing and Waterproofing Manual; Fifth Edition, with interim updates.

1.04 SUBMITTALS

A. See Section , for submittal procedures.

B. Product Data: Provide data for flexible flashings and other accessories.

C. Warranty: Submit manufacturer warranty and ensure forms have been completed in District's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Flashing Manufacturer Qualifications: Company specializing in waterproofing flashings with ten years experience.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Contractor shall correct defective Work within a five year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no extra cost to District.

C. Provide 30 year manufacturer warranty for flashing failing to resist penetration of water. Warranty to cover replacement of defective product as well as pay reasonable labor and material construction costs, including for work necessary to repair any damaged wall system components.

PART 2 PRODUCTS

2.01 FLASHING MATERIALS

A. Self-Adhered Modified Bituminous Membrane:
   1. Thickness: 40 mil 0.040 inch
   2. Sheet Width: 4, 6, 9, 12, or 36 inch width as required for installation.
   3. Tensile Strength:

a. Membrane: 580 pounds per square inch, minimum, measured according to ASTM D412 Method A, using die C and at spindle-separation rate of 2 inches per minute.
4. Elongation at Break: 500 percent, minimum, measured according to ASTM D412.
5. Water Vapor Permeance: 0.008 perm, maximum, measured in accordance with ASTM E96/E96M.
6. Low Temperature Flexibility: Unaffected when tested according to ASTM D1970/D1970M at minus 20 degrees F, 180 degree bend on 1 inch mandrel.
7. Water Absorption: 0.20 percent when tested in accordance with ASTM 1228
8. Sealants, Tapes and Accessories: As recommended by flashing manufacturer.
9. Manufacturers:
   a. Top Industrial Inc.; Rain Buster 415 : www.topindustrial.com
   b. Carlisle Coatings & Waterproofing Incorporated; www.carlisleccw.com/sle.
   c. W.R. Meadows, Inc: www.wrmeadows.com/sle.

2.02 ACCESSORIES

A. Corner Flashings: premanufactuered inside and outside once piece corner flashing utilized at corner transitions.
   1. Material: Low density polyethylene
   2. Manufacturers:
      a. Top Industrial Inc.; Rain Buster 435 : www.topindustrial.com

B. Sealant : Resilient polyurethane joint sealant compatible with substrates and flashing materials.
   1. Hardness (Shore A) per ASTM D2240 : 43
   2. Tensile Strength per ASTM D412: 225 psi
   3. Elongation per ASTM D412: 900%
   4. Adhesion in Peel per ASTM C794: Pass
   5. Stain & Color Change per ASTM C510: None
   6. Joint Movement Capability per ASTM C719: plus or minus 25%
   7. UV Resistance per ASTM C793: Excellent
   8. Color: White
   9. Manufacturers:
      a. Top Industrial Inc.; Rain Buster 450 : www.topindustrial.com

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.

C. Verify that items that penetrate surfaces to receive waterproofing are securely installed.

3.02 PREPARATION

A. Clean and prepare surfaces to receive flexible flashing in accordance with manufacturer's instructions. Vacuum substrate clean.

B. Do not apply flexible flashing to surfaces unacceptable to flashing manufacturer.

C. Seal moving cracks with sealant, not rigid filler, using procedures recommended by sealant and waterproofing manufacturers.

D. Prepare building expansion joints as indicated on drawings.

3.03 INSTALLATION

A. Install flexible flashing in accordance with manufacturer's instructions for level 3 installation.

B. Self-Adhering Flashing: Apply flashing in accordance with manufacturer's instructions. Bond sheet to substrate except those areas directly over or within 3 inches of a control or expansion joint.

C. Mechanically Fastened Flashing: Install mechanical fasteners in accordance with manufacturer's instructions.

D. Overlap edges and ends and seal by method recommended by manufacturer, minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.

E. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.

F. Weather lap joints on sloped substrate in direction of drainage. Seal joints and seams.

G. Coordinate with weather barrier installation; see 07 2500 - Weather Barriers

H. Install building expansion joints as indicated on drawings.

I. Install flexible flashings. Seal items penetrating through membrane with flexible flashings. Seal watertight to membrane.

3.04 FIELD QUALITY CONTROL

A. Installation of flexible flashing to be observed by manufactuer's representative. Manufacturer to provide memo stating observations.

END OF SECTION

Section 07 8400
Firestopping

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 REFERENCE STANDARDS

A. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

B. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2024.

C. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).

D. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2015 (Reapproved 2019).

E. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestops; 2014.

F. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2010a.

G. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus; 2015a.

H. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies; 2013.

I. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

J. ITS (DIR) - Directory of Listed Products; Current Edition.

K. FM (AG) - FM Approval Guide; Current Edition.

L. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.

M. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

N. UL (DIR) - Online Certifications Directory; Current Edition.

O. UL (FRD) - Fire Resistance Directory; Current Edition.

1.03 SUBMITTALS

A. See Section 01 3300 - Submittals for submittal procedures.

B. Product Data: Provide data on product characteristics, performance ratings, and limitations.

C. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Installer's qualification statement.

1.04 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
   1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.

B. Installer Qualifications: Company specializing in performing the work of this section and:
   1. Verification of minimum three years documented experience installing work of this type.
   2. Verification of at least five satisfactorily completed projects of comparable size and type.

1.05 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Firestopping Manufacturers:
   1. 3M Fire Protection Products; _____: www.3m.com/firestop/#sle.
   2. Hilti, Inc; _____: www.hilti.com/#sle.

3. Tremco Commercial Sealants & Waterproofing; TREMstop Acrylic: www.tremcosealants.com/#sle.

2.02 MATERIALS

A. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
   1. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
   2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
   3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
   4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

B. Acoustically Rated Firestopping: Provide system tested in accordance with ASTM E90 with STC rating of 50, minimum.

2.04 FIRESTOPPING PENETRATIONS THROUGH GYPSUM BOARD WALLS

2.05 FIRESTOPPING SYSTEMS

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to prevent liquid material from leakage.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by District's Independent Testing Agency.

C. Do not cover installed firestopping until inspected by authorities having jurisdiction.

D. Install labeling required by code.

3.04 FIELD QUALITY CONTROL

A. Independent Testing Agency: Inspection agency employed and paid by District, will examine penetration firestopping in accordance with ASTM E2174 and ASTM E2393.

B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.05 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.06 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

Section 07 9200
Joint Sealants

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Self-leveling pourable joint sealants.

C. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Additional requirements for sealants and primers.

B. Section 07 4646 - Fiber Cement Siding: Sealants installed as part of installation

C. Section 09 2116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

D. Section 09 3000 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

E. 32 1313 - Concrete Paving: Sealant at expansion joints

1.03 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015 (Reapproved 2022).

B. ASTM C834 - Standard Specification for Latex Sealants; 2017.

C. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2022.

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

E. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:

1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
2. List of backing materials approved for use with the specific product.
3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
4. Substrates the product should not be used on.

B. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Nonsag Sealants:
1. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
2. Bostik Inc: www.bostik-us.com.
3. Dow Corning Corporation: www.dowcorning.com/construction/sle.
4. Hilti, Inc: www.us.hilti.com/#sle.
5. Pecora Corporation: www.pecora.com.
6. Tremco Global Sealants: www.tremcosealants.com.
7. Sherwin-Williams Company: www.sherwin-williams.com.
8. Sika Corporation: www.usa-sika.com.
9. W.R. Meadows, Inc: www.wrmeadows.com/sle.

B. Self-Leveling Sealants:
1. Bostik Inc: www.bostik-us.com.
2. Dow Corning Corporation: www.dowcorning.com/construction/sle.
3. Pecora Corporation: www.pecora.com.
4. Tremco Global Sealants: www.tremcosealants.com.
5. Sika Corporation: www.usa-sika.com.
6. W.R. Meadows, Inc: www.wrmeadows.com/sle.

2.02 JOINT SEALANT APPLICATIONS

A. Scope:
1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to:
   a. Wall expansion and control joints.
   b. Joints between different exposed materials.
   c. Expansion joints in paving.
   d. Other joints indicated below.
2. Do Not Seal:
   a. Intentional weep holes in masonry.
   b. Joints where sealant is specified to be furnished and installed by manufacturer of product to be sealed.

c. Joints where sealant installation is specified in other sections.

B. Exterior Joints: Use nonsag polyurethane sealant, unless otherwise indicated.
1. Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.

C. Interior Joints: Use nonsag polyurethane polyurethane sealant, unless otherwise indicated.
1. Wall and Ceiling Joints in Nonwet Areas: Acrylic emulsion latex Acrylic emulsion latex sealant.
2. Joints between Tile in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white white.
3. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.

D. Interior Wet Areas: restrooms; fixtures in wet areas include plumbing fixtures, countertops, and cabinets.

2.03 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products with acceptable levels of volatile organic compound (VOC) content; see Section 01 6116.

B. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

C. Colors: As as selected by architect from manufacturer's full range

2.04 NONSAG JOINT SEALANTS

A. Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 25 percent, minimum.
2. Color: Match adjacent finished surfaces.

B. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
1. Color: White.

C. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, nonstaining, nonbleeding, nonsagging; not intended for exterior use.
1. Color: Standard colors matching finished surfaces, Type OP (opaque).

2.05 SELF-LEVELING JOINT SEALANTS

A. Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multicomponent; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion .
1. Movement Capability: Plus and minus 25 percent, minimum.

2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
3. Color: Gray.
4. Products:
   a. Pecora Corporation; Urexpan NR-200 and/or Dynatred: www.pecora.com.
   b. Sherwin-Williams Company; Loxon SL1 Polyurethane Self-Leveling Sealant: www.sherwin-williams.com.
   c. Sherwin-Williams Company; Loxon SL2 Polyurethane Self-Leveling Sealant: www.sherwin-williams.com.
   d. Sika Corporation; Sikaflex-1c SL: www.usa.sika.com/#sle.
   e. Sika Corporation; Sikaflex-2c SL: www.usa.sika.com/#sle.

2.06 ACCESSORIES

A. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

B. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

C. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.

D. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.03 INSTALLATION

A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Provide joint sealant installations complying with ASTM C1193.

C. Install acoustical sealant application work in accordance with ASTM C919.

D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

E. Install bond breaker backing tape where backer rod cannot be used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

3.04 POST-OCCUPANCY

A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width, i.e., at low temperature in thermal cycle. Report failures immediately and repair them.

END OF SECTION

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Section 08 1213
Hollow Metal Frames

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal frames for non-hollow metal doors.

B. Interior glazed borrowed lite frames.

1.02 RELATED REQUIREMENTS

A. Section 08 1416 - Wood Doors: Non-hollow metal door for hollow metal frames.

B. Section 08 7100 - Door Hardware: Hardware, silencers, and weatherstripping.

C. Section 08 8000 - Glazing: Glazed borrowed lites.

D. Section 09 9123 - Interior Painting: Field painting.

1.03 REFERENCE STANDARDS

A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights; 2022.

B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2017.

D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2020.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2021a.

G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.

H. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames; 2016.

I. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

J. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.

K. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.

L. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2017.

1.04 SUBMITTALS

A. See Section 01 3300 - Submittals for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced grade standard.

C. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

D. Manufacturer's qualification statement.

E. Installer's qualification statement.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in accordance with applicable requirements and in compliance with standards and/or custom guidelines as indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Frames with Integral Casings:
   1. Ceco Door, an Assa Abloy Group company; _____: www.assaabloydss.com/#sle.
   2. Curries, an Assa Abloy Group company; _____: www.assaabloydss.com/#sle.
   3. Republic Doors, an Allegion brand; ____: www.republicdoor.com/#sle.
   4. Steelcraft, an Allegion brand; ____: www.allegion.com/#sle.

2.02 PERFORMANCE REQUIREMENTS

A. Hollow Metal Frames: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific frame type:
   1. Performance Class (PC): AW.

B. Door Frame Type:
   1. Interior Doors: Use frames with integral casings.
   2. See drawings for locations of each type of frame.

C. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.

D. Accessibility: Comply with ICC A117.1 and ADA Standards.

E. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturers standard.

F. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior frame that is also indicated as being sound-rated must comply with the requirements specified for exterior frames and for sound-rated frames; where two requirements conflict, comply with the most stringent.

G. Hardware Preparations, Selections and Locations: Comply with BHMA A156.115, NAAMM HMMA 830, NAAMM HMMA 831 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

H. Frames for Interior Glazing or Borrowed Lites: Construction and face dimensions to match door frames, and as indicated on drawings.

2.03 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.04 ACCESSORIES

A. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 INSTALLATION

A. Install frames in accordance with manufacturer's instructions and related requirements of specified frame standards or custom guidelines indicated.

B. Coordinate frame anchor placement with wall construction.

C. Comply with glazing installation requirements of Section 08 8000.

D. Install door hardware as specified in Section 08 7100.

3.03 TOLERANCES

A. Maximum Diagonal Distortion: 1/16 inch measured with straight edges, crossed corner to corner.

3.04 SCHEDULE - SEE DRAWINGS

A. Refer to Door and Frame Schedule on the drawings.

End of Section

Section 08 1400
Wood Doors

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wood doors with high pressure laminated faces packaged with frames and hinges

1.02 RELATED REQUIREMENTS

A. Section 08 1113 - Hollow Metal Doors and Frames.

B. Section 08 1213 - Hollow Metal Frames.

C. Section 08 7100 - Door Hardware.

D. Section 08 8000 - Glazing.

1.03 REFERENCE STANDARDS

A. AAMA 1304; Voluntary Specification for Forced Entry Resistance of Side-Hinged Door Systems.

B. ASTM E283; Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

C. ASTM E330; Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Pressure Difference

D. ASTM E331; Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference

E. ASTM E547; Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference

F. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association; 2012.

G. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Obtain hardware templates from hardware manufacturer prior to starting fabrication.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.

D. Specimen warranty.

E. Samples: For prefinished doors submit two samples of door veneer, 10 x 10 inch in size illustrating color and finish.

F. Warranty, executed in District's name.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging. Inspect for damage.

C. Store in position recommended by manufacturer, elevated minimum 4 inches above grade, with minimum 1/4 inches space between doors.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Interior Doors: Provide manufacturer's warranty for 3 years.

C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Low Pressure Decorative Laminate Faced Doors:
   1. Maiman Company; Thermal Fused doors: www.maiman.com.
   2. _____Or equal.

2.02 DOOR AND FRAME ASSEMBLIES

A. Door and Frame Assemblies: Factory-fabricated, prepared and machined for hardware.
   1. Door and frame pre-assembled; shipped with braces, spreaders, and packaging as required to prevent damage.
   2. Sizes: As indicated on drawings.
   3. Clearance Between Door and Frame: 1/8 inch, maximum.
   4. Clearance Between Bottom of Door and Finished Floor: 3/4 inch, maximum; not less than 1/4 inch clearance to threshold.
   5. Provide frame anchors that allow for variation in rough opening size; do not field cut doors or frames to fit.
      a. In retrofit applications door may be trimmed to fit following manufacturer's recommendations provided trimming will not void certification.

B. Fire Rated Doors and Frames: Ratings indicated on drawings.
   1. Tested in accordance with International Building Code ("positive pressure") or UL 10C or UBC Standard 7-2 ("positive pressure").

C. Sound Retardant Doors: Minimum STC of 30, calculated in accordance with ASTM E413, tested in accordance with ASTM E1408.

D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

F. Provide edge clearances in accordance with the quality standard specified.

2.03 HIGH PRESSURE LAMINATE FACED DOORS

A. Door Design: As selected by Owner

B. Thickness 1 3/8 inch

C. Surface finish: smooth

D. Core and frame: Solid core with MDF frame

E. Hardware finish: as selected by Owner

F. Finish: Preprimed for field painting

2.04 ACCESSORIES

A. Metal Louvers:
   1. Material and Finish: Roll formed steel; pre-painted finish to color as selected.

B. Glazing Stops: Rolled steel channel shape, butted corners; prepared for countersink style screws.

C. Astragals for Non-Rated Double Doors: Steel, T shaped, overlapping and recessed at face edge.

2.05 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.

B. Field-Finished Doors: Trimming to fit is subject to door manufacturer recommendations.
   1. Adjust width of non-rated doors by cutting equally on both jamb edges.
   2. Trim maximum of 3/4 inch off bottom edges.

C. Use machine tools to cut or drill for hardware.

D. Coordinate installation of doors with installation of frames and hardware.

E. Coordinate installation of glazing.

3.03 TOLERANCES

A. Conform to specified quality standard for fit and clearance tolerances.

B. Conform to specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

3.05 SCHEDULE

A. Refer to drawings for schedule - in general:
   1. Common Area Interior Doors: Solid core wood veneer
   2. Exterior Service Doors: See 08 1113 Hollow Metal Doors and Frames

END OF SECTION

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Section 08 4313
Aluminum-Framed Storefronts

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.

B. Aluminum doors and frames.

C. Weatherstripping.

D. Door hardware.

E. Perimeter sealant.

F. All required attachments, trim, and accessories to provide a complete installation.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry

B. Section 07 9005 - Joint Sealers: Perimeter sealant and back-up materials.

C. Section 08 5113 - Aluminum Windows: Operable sash within glazing system.

D. Section 08 7100 - Door Hardware: Hardware items other than specified in this section.

E. Section 08 8000 - Glazing: Glass and glazing accessories.

F. Section 12 2113 - Horizontal Louver Blinds: Attachments to framing members.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.

B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.

C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

D. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

F. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

G. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

H. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

1.05 PERFORMANCE REQUIREMENTS

A. Design and size components to withstand the following load requirements without damage or permanent set, when tested in accordance with ASTM E 330, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
   1. Design Wind Loads: Comply with requirements of California Building code.
      a. 70 mph wind speed, exposure C
   2. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.

B. Movement: Accommodate movement between storefront and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.

C. Air Infiltration: Limit air infiltration through assembly to 0.06 cu ft/min/sq ft of wall area, measured at a reference differential pressure across assembly of 1.57 psf as measured in accordance with ASTM E 283.

D. Water Leakage: None, when measured in accordance with ASTM E 331 with a test pressure difference of 6.00 lbf/sq ft.

E. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

F. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.

1.06 SUBMITTALS

A. See Section 01 3300 - Submittals for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.

D. Samples: Submit two samples 6 inches long illustrating finished aluminum surface .

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

B. Installer - The storefront installer shall be currently approved by the manufacturer, and have experience of at least five (5) years installing the selected system.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

C. Replacements - In the event of damage, including water intrusion, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the University.

1.09 FIELD CONDITIONS

1.10 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

D. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. All storefront and entrances system components shall be the product of a single manufacturer and represent an integrated system.

B. The aluminum storefront system was designed based on the product of Kawneer as a standard of quality.

2.02 ALUMINUM-FRAMED STOREFRONT

A. Glazing: Refer to Section 08 8000 Glazing.

B. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Glazing Position: Front-set.
   2. Condensation Resistance Factor: 40 minimum
   3. Finish: Superior performing organic coatings.
      a. Factory finish all surfaces that will be exposed in completed assemblies.
      b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
   4. Finish Color: Black.
   5. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
   6. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
   7. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
   8. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
   9. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
   10. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

C. Performance Requirements
   1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
      a. Design Wind Loads: Comply with requirements of ASCE 7.
      b. Member Deflection: Limit member deflection to 1/175 in any direction, with full recovery of glazing materials.

2. Air Leakage: 0.06 cfm/sq ft maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf pressure difference.

2.03 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
1. Framing members for interior applications need not be thermally broken.
2. Fabrication Method – Shearblock or equal. Use of exposed fasteners and stacking system with receptor sill not acceptable.
3. Glazing Stops: Flush.

B. Doors: Glazed aluminum. Series 500 wide Stile
1. Thickness: 1 3/4 inches.
2. Top Rail: 6 inches wide.
3. Vertical Stiles: 6 inches wide.
4. Bottom Rail: 10 inches wide.
5. Glazing Stops: Square.
6. Finish: Same as storefront.
7. Pull Handles: See Section 08 7100
8. Hinges: Kawneer 4 1/2 x4 ball bearing butt hinge with non-removable pin or equal electrified hinge where required.
9. Exit Device: See Section 08 7100

2.04 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Fasteners: Stainless steel.

C. Perimeter Sealant: Type _____ specified in Section 07 9005.

D. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

2.05 FINISHES

A. Comply with AA DAF-45 for aluminum finishes required.

B. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils thick.

2.06 HARDWARE

A. General: Refer to Section 08710 “Door Hardware” for requirements for hardware items other than those indicated to be provided by the aluminum entrance manufacturer.
1. Coordinate with hardware provider regarding electronic access control - provide components required for a complete system.

B. Provide heavy-duty hardware units as indicated, scheduled, or required for operation of each door, including the following items of sizes, number, and type recommended by manufacturer for service required; finish to match door.
   1. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.
   2. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.

2.07 FABRICATION

A. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

B. Develop drainage holes with moisture pattern to exterior.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Coordinate attachment and seal of perimeter air and vapor barrier materials.

I. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

J. Install hardware using templates provided.

K. Install glass and infill panels using glazing method required to achieve performance criteria; see Section 08 8000.

L. Install perimeter sealant in accordance with Section 07 9005.

M. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.04 ADJUSTING

A. Adjust operating hardware and sash for smooth operation.

B. Opening force for doors not to exceed 5 lbs of force

3.05 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Remove excess sealant by method acceptable to sealant manufacturer.

3.06 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

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Section 08 8000
Glazing

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulating glass units.

B. Glazing units.

C. Glazing compounds.

1.02 RELATED REQUIREMENTS

A. Section 07 9200 - Joint Sealants: Sealants for other than glazing purposes.

B. Section 08 1213 - Hollow Metal Frames: Glazed borrowed lites.

C. Section 08 1400 - Wood Doors: Glazed lites in doors.

D. Section 08 4313 - Aluminum-Framed Storefronts: Glazing provided as part of storefront assembly.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2011).

E. ASTM C1036 - Standard Specification for Flat Glass; 2021.

F. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.

G. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2021a.

H. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.

I. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2019.

J. GANA (GM) - GANA Glazing Manual; 2022.

K. GANA (SM) - GANA Sealant Manual; 2008.

L. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2023.

1.04 SUBMITTALS

A. See Section 01 3300 - Submittals for submittal procedures.

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

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Samples: Submit two samples 12 by 12 inch in size of glass units.

E. Certificate: Certify that products of this section meet or exceed specified requirements.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

H. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in District's name and registered with manufacturer.

I. Maintenance Materials: Furnish the following for District's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Insulating Glass Units: One of each glass size and each glass type.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM) for glazing installation methods.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 5 years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1.06 FIELD CONDITIONS

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

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
   1. Warranty Period: 10 years.

C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
   1. Warranty Period: 10 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Float Glass Manufacturers:
   1. Guardian Industries Corp: www.sunguardglass.com. Basis of Design. Rep= Kim Cahners (310)600-9327
   2. Pilkington North America Inc: www.pilkington.com/na.
   3. PPG Industries, Inc; Basis of Design: www.ppgideascapes.com.
   4. Oldcastle Building Envelope: www.obe.com

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
   1. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
   2. Seismic Loads: Design and size glazing components to withstand seismic loads and sway displacement in accordance with the requirements of ASCE 7.
   3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
   4. Glass thicknesses listed are minimum.

B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.
   1. In conjunction with weather barrier related materials described in other sections, as follows:

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated in Energy Compliance Documents. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
   1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.
   1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
   2. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.

2.04 INSULATING GLASS UNITS

A. Manufacturers:
   1. Glass: Any of the manufacturers specified for float glass.
   2. Fabricator certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.
   3. Guardian Glass, LLC; _____: www.guardianglass.com/#sle. Basis of Design.
   4. Pilkington North America Inc; _____: www.pilkington.com/na/#sle.Pilkington North America Inc; _____: www.pilkington.com/na/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Insulating Glass Units: Types as indicated.
   1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
   2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
   3. Spacer Color: Black.
   4. Edge Seal:
      a. Color: Black.
   5. Purge interpane space with dry air, hermetically sealed.

C. Type IG-1 - Insulating Glass Units: Vision glass, double glazed.
   1. Applications: Exterior glazing unless otherwise indicated.
   2. Space between lites filled with argon.
   3. Outboard Lite: Annealed float glass, 1/4 inch thick, minimum.
      a. Tint: No tinting. Clear glass.
      b. Coating: Self-cleaning type, on #2 surface.
      c. Coating: Low-E (solar control type). Sunguard SNX 51/23 on #2 surface.
   4. Inboard Lite: Annealed float glass, 1/4 inch thick, minimum.
      a. Tint: Clear, except sandblasted for obscurity at restrooms
      b. Coating: Acid etched at Restrooms only, on #3 surface.

5. Total Thickness: 1 inch.
6. Thermal Transmittance (U-Value), Summer - Center of Glass: 0.24 maximum.
7. Visible Light Transmittance (VLT): .05, nominal.
8. Solar Heat Gain Coefficient (SHGC): 0.23 maximum.
9. Glazing Method: Dry glazing method, gasket glazing.

2.05 ACCESSORIES

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option I. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

D. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option I. Minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.

E. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

F. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

G. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

C. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry immediately before glazing. Remove coatings that are not tightly bonded to substrates.

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

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove nonpermanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.06 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

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SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Door hardware.
2. Cylinders for doors fabricated with locking hardware.

B. Related Divisions:

1. Division 06 – door hardware installation
2. Division 07 – Section “Joint Sealants” for sealant requirements applicable to threshold installation specified in this section.
3. Division 08 – metal doors and frames, wood doors, integrated security systems, specialty doors, storefront and glazed curtainwall systems.

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

1. Windows.
2. Cabinets, including open wall shelving and locks.
3. Signs.
4. Toilet accessories, including grab bars.
5. Installation.
6. Rough hardware.

1.2 REFERENCES:

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

1. American National Standards Institute
   a) ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties.
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. WHI – Warnock Hersey Incorporated State of California Building Code
6. Local applicable codes
7. SDI – Steel Door Institute
8. WI – Woodwork Institute
9. AWI – Architectural Woodwork Institute
10. NAAMM – National Association of Architectural Metal Manufacturers

B. Abbreviations

1. Manufacturers: see table at 2.1.A of this section.
2. Finishes: see 2.5 of this section.

1.3 SUBMITTALS & SUBSTITUTIONS

A. SUBMITTALS: Submit electronic copy of schedule. 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.

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. Qualifications:

1. Hardware supplier: direct factory contract supplier who employs a hardware consultant, available at reasonable times during course of work for project hardware consultation to Owner, Architect and Contractor.

a) Responsible for detailing, scheduling, and ordering of finish hardware. Detailing implies that the submitted schedule of hardware is correct and complete for the intended function and performance of the openings.

B. Hardware: Free of defects, blemishes, and excessive play. Obtain each kind of hardware (latch and locksets, exit devices, hinges, and closers) from one manufacturer.

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

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. Note: Careful coordination required for reinforcement/blocking for wall stop support. If random inspection yields an unsupported wall stop, all locations will be rebuilt at no expense to the Owner or Architect.
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 out swinging 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.	Extra Heavy-Duty Cylindrical Lock:	Ten years mechanical
2.	Hinges:	One year
3.	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. Cavities created by kickplates to be capped per 2022 California Building Code Section 11B-404.2.10.
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: In alterations, a projection of 5/8 inch (15.9 mm) maximum into the required clear width shall be permitted for the latch side stop.
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, per DSA Policy #99-08 (Access).

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.

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
Key System	(C-R) Corbin-Russwin	Owner standard
Mechanical Locks	(SCH) Schlage	Owner standard
Overhead Stops	(GLY) Glynn-Johnson	ABH
Seals & Bottoms	(ZER) Zero	NGP, Pemko

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. Out-swinging 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. Extra Heavy Duty Cylindrical Locks and Latches: as scheduled.

1. Chassis: cylindrical design, corrosion-resistant plated cold-rolled steel, through-bolted.
2. Locking Spindle: stainless steel, integrated spring and spindle design.
3. Latch Retractors: forged steel. Balance of inner parts: corrosion-resistant plated steel, or stainless steel.
4. Latchbolt: solid steel.
5. Backset: 2.75 inches typically, more or less as needed to accommodate frame, door or other hardware.
6. Lever Trim: accessible design, independent operation, spring-cage supported, minimum 2.00 inches clearance from lever mid-point to door face.
7. Strikes: 16 gage curved steel, bronze or brass with 1.00-inch-deep box construction, lips of sufficient length to clear trim and protect clothing.
8. Lock Series and Design: Schlage ND series, "Rhodes" design.
9. Certifications:

    a) ANSI A156.2, Series 4000, Grade 1.
    b) UL listed for A label and lesser class single doors up to 4 feet x 8 feet.

10. 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
11. Accepted substitutions: None.

2.4 OTHER HARDWARE

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

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

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

C. Seals: Four-fingered type at head & jambs. Inelastic, rigid back, not subject to stretching. Self-compensating for warp, thermal bow, door settling, and out-of-plumb. Adhesive warranted for life of installation.

1. Proposed substitutions: submit for approval.
2. Three-fingered type at hinge jambs of doors fitted with continuous hinges where jamb leaf of hinge is fastened to the frame reveal.

D. 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.

2.5 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.

2.6 KEYING REQUIREMENTS:

A. Key System: existing Corbin-Russwin system. Initiate and conduct meeting(s) with Owner to determine system structure, furnish Owner's written approval of the system; do not order keys or cylinders without written confirmation of actual requirements from the Owner. Furnish temporary construction-keyed and permanent cylinders. Contractor to demonstrate to the Owner that temporary keys no longer operate the locking cylinders at the end of the project.

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 1008.1.9.2 and 11B-404.2.7.
2. 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.

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. Use manufacturers' fasteners furnished with hardware items or submit Request for Substitution with Architect.
3. Replace fasteners damaged by power-driven tools.

B. Locate floor stops no more than 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. Locate overhead stops for minimum 90 degrees at rest and for maximum allowable degree of swing.

D. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

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

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.

B. 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, 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.

Opt. #: OPT0427926-V1

HARDWARE GROUP NO. 01
Provide each PD door(s) with the following:

1	SET	POCKET DOOR TRACK ASSEMBLY	C-810			KNC
1	EA	DOOR PULL, 3/4" RND	PR 8102HD 8" J		626	IVE

HARDWARE GROUP NO. 02
Provide each SGL door(s) with the following:

3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50JSARD RHO		626	SCH
1	EA	IC PERMANENT CORE	AS REQUIRED PER DISTRICT STANDARD		626	C-R
1	EA	FLOOR STOP	FS436/FS438 AS REQ'D		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

HARDWARE GROUP NO. 03
Provide each SGL door(s) with the following:

3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND80JSARD RHO		626	SCH
1	EA	IC PERMANENT CORE	AS REQUIRED PER DISTRICT STANDARD		626	C-R
1	EA	OH STOP	90S		630	GLY
1	EA	GASKETING	488SBK PSA		BK	ZER

END OF SECTION

Section 09 2116
Gypsum Board Assemblies

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cementitious backing board.

B. Gypsum wallboard.

C. Joint treatment and accessories.

D. Textured finish system.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry.

B. Section 07 2100 - Board and Batt Insulation

C. Section 07 9200 - Joint Sealants

D. Section 09 3000 - Tiling

1.03 REFERENCE STANDARDS

A. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2018.

B. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 2019.

C. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2020.

D. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel; 2017.

E. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units; 2022.

F. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.

G. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

H. GA-216 - Application and Finishing of Gypsum Panel Products; 2021.

1.04 SUBMITTALS

A. See Section 01 3300 - Submittals for submittal procedures.

B. Product Data: Provide data on gypsum board, accessories, and joint finishing system.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum 3 years of experience.

PART 2 PRODUCTS

2.01 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. CertainTeed Corporation: www.certainteed.com.
   2. Georgia-Pacific Gypsum: www.gpgypsum.com.
   3. National Gypsum Company: www.nationalgypsum.com.
   4. USG Corporation: www.usg.com.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
      a. Mold resistant board is required within 10 feet of a sink and other plumbing fixtures and within at least 2 feet around and perpendicular to exterior door openings.
   3. Thickness:
      a. Vertical Surfaces: 5/8 inch.
      b. Ceilings: 5/8 inch.

C. Backing Board For Wet Areas:
   1. Application: Surfaces behind tile in wet areas including full length of walls in toilet rooms and vestibule where plumbing fixtures are mounted..
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.

D. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
   1. Application: Walls and ceilings at toilet rooms and vestibule where there is no plumbing fixture mounted..
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. Regular Board Thickness: 5/8 inch.
   4. Edges: Tapered.
   5. Products:

a. American Gypsum Company; M-Bloc: www.americangypsum.com/#sle.
b. CertainTeed Corporation; ProRoc Brand Moisture & Mold Resistant Gypsum Board.
c. Georgia-Pacific Gypsum; ToughRock Mold-Guard Gypsum Board: www.gpgypsum.com/#sle.
d. Georgia-Pacific Gypsum; DensShield Tile Backer.
e. USG Corporation; Sheetrock Brand Mold Tough Gypsum Panels.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
1. Place continuous bead at perimeter of each layer of gypsum board.

C. Caulking for Sound Control: Insulate construction with caulk as indicated on Drawings. In additon, caulk penetrations at conduit, pipes, ducts, registers, etc., so that such openings are sealed tight against passage of airborne sound.
1. Holes smaller than 1" but too large to cauld shall be packed with glass fiber, sealed over with 1/16 inch thick sheet lead and then cauled airtight.
2. Seal the back of electrical boxes in sound insulated construction airtight using specified resilient sealer pads.
3. Conceal caulking and sealing where possible; where caulking must remain exposed, use skinning type material and neatly tool.

3.03 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
1. Exception: Tapered edges to receive joint treatment at right angles to framing.

C. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.

D. Cementitious Backing Board: Install over wood framing members where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.

E. Installation on Wood Framing: For nonrated assemblies, install as follows:
1. Single-Layer Applications: Screw attachment.

F. Installation over concrete curbs: adhesive application

3.04 INSTALLATION OF TRIM AND ACCESSORIES

A. Corner Beads: Install at external corners, using longest practical lengths.

B. Edge Trim: Install at exposed edges and ends and at untrimmed joints lwhere gypsum board abuts dissimilar materials. Where edge trim is required at wallboard edget, and headers, studs, still or other backing are not available for positive fastening of trim, apply trim to board with contact type adhesive..

C. Moisture Guard Trim: Install on bottom edge of gypsum board according to manufacturer's instructions and in locations indicated on drawings.

3.05 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

3.06 CLEANING

A. Do not allow the accumulation of scraps and debris arising from the work of this Section but maintain the premises in a neat and orderly condition. In the event of spilling or splashing compound onto other surfaces, immediately remove the spilled or splashed material and trace residue to the approval of the Architect.

END OF SECTION

Section 09 2216
Non-Structural Metal Framing

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal partition, ceiling, and soffit framing.

B. Framing accessories.

1.02 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications: Metal fabrications attached to stud framing.

B. Section 05 5000 - Metal Fabrications: Execution requirements for anchors for attaching work of this section.

C. Section 06 1000 - Rough Carpentry: Wood blocking within stud framing.

D. Section 07 6200 - Sheet Metal Flashing and Trim: Head and sill flashings.

1.03 REFERENCE STANDARDS

A. AISI S201 - North American Standard for Cold-Formed Steel Framing - Product Data; 2017.

B. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.

C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2024.

D. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.

E. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

1.04 SUBMITTALS

A. See Section 01 3300 - Submittals for submittal procedures.

B. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Framing, Connectors, and Accessories:
   1. CEMCO; ____: www.cemcosteel.com/#sle.
   2. ClarkDietrich; _____: www.clarkdietrich.com/#sle.
   3. Simpson Strong Tie; ____: www.strongtie.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FRAMING MATERIALS

A. Non-Loadbearing Framing System Components: AISI S220; sheet steel, of size and properties necessary for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.
   1. Studs: C-shaped with flat faces.
   2. Studs: C-shaped with triangular-shaped, lipped holes.
   3. Runners: U-shaped, sized to match studs.

B. Non-Loadbearing Framing Accessories:
   1. Sheet Metal Backing: 0.036 inch thick.
   2. Fasteners: ASTM C1002 self-piercing self-tapping screws.
   3. Anchorage Devices: Powder actuated.
   4. Acoustic Insulation: ASTM C665; preformed mineral-fiber, friction fit type, unfaced; thickness ___ inch.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

3.02 INSTALLATION OF STUD FRAMING

A. Comply with requirements of AISI S220.

B. Extend partition framing to structure where indicated and to ceiling in other locations.

C. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

D. Align and secure top and bottom runners at 24 inches on center.

E. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.

F. Install studs vertically at spacing indicated on drawings.

G. Align stud web openings horizontally.

H. Secure studs to tracks using crimping method. Do not weld.

I. Stud splicing is not permissible.

J. Fabricate corners using a minimum of three studs.

K. Install double studs at wall openings, door and window jambs, not more than 2 inches from each side of openings.

L. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.

M. Furring: Install at spacing and locations shown on drawings. Lap splices a minimum of 6 inches.

N. Use sheet metal backing for reinforcement of equipment anchorage.

END OF SECTION

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Section 09 2236
Lath

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal lath for cement and gypsum plaster.

1.02 RELATED REQUIREMENTS

A. Section 07 2500 - Weather Barriers: Water-resistive barrier under exterior plaster and stucco.

B. Section 09 2400 - Cement Plastering.

1.03 REFERENCE STANDARDS

A. ASTM A641 - Standard Specification for Zinc–Coated (Galvanized) Carbon Steel Wire

B. ASTM C847 - Standard Specification for Metal Lath; 2018.

C. ASTM C933 - Standard Specification for Welded Wire Lath; 2023.

D. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.

E. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.

F. ASTM C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster; 2024.

1.04 SUBMITTALS

A. Product Data: Provide data on furring and lathing components, structural characteristics, material limitations, and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with specifications, provide products as manufactured by one of the following
   1. Metal Lath and Accessories:

a. Alabama Metal Industries Corporationwww.amico-lath.com.
b. Cemcowww.cemcosteel.com. (Basis of Design)
c. Clarkwestern Dietrich Building Systems LLCwww.clarkdietrich.com.
d. Fry Reglet: fryreglet.com

2.02 LATH

A. All lath must be recognized by a current evaluation report issued by ICC ES.

B. Diamond Mesh Metal Lath: ASTM C847, galvanized; self-furring.
1. Weight: 3.4 lb/sq yd.

C. Ribbed Metal Lath: ASTM C847, galvanized; 3/8 inch thick.
1. Weight: 3.4 lb/sq yd.

D. Welded Wire Lath: ASTM C933; galvanized per ASTM A641/A641M; with 1 1/2 inch by 1 1/2 inch openings
1. 17 gauge wire
2. Self furring depth: 3/16 inch minimum
3. Self furring spacing: 3 inches on center

E. Strip Mesh: Expanded metal lath, same weight as diamond mesh lath, 4 inch wide by 24 inch long; galvanized.

F. Beads, Screeds, Joint Accessories, and Other Trim: Depth governed by plaster thickness, and maximum possible lengths.
1. Material: Aluminum, 6063 T5 alloy, clear anodized
2. Casing Beads with Weep Holes: Square edges.
3. Corner Beads: Straight corners.
a. Products:
1) Clark Dietrich; Wire Corner Reinforcement.
2) Clark Dietrich; V Truss Corner Reinforcing.
3) Cemco; Cemcorner.
b. Galvanized wire
c. Products:
4. Base Screeds:
a. 7/8 inch ground
b. 26 ga.
c. Galvanized
d. 3 1/2 inch minimum vertical attachment flange
5. Reveal Joints: One piece with vertical sides.
a. Size: Width varies, 1 inch and 3 inch, see architectural elevations for locations.
b. Material: 6063 T5 aluminum
c. Color: Clear annodized
d. Product: Fry Reglet, PA.1

2.03 ACCESSORIES

A. Anchorage: Tie wire, nails, and other metal supports, of type and size to suit application; to rigidly secure materials in place, galvanized and conforming with ASTM C-1063

B. Fasteners: Self-piercing tapping screws; ASTM C1002 or ASTM C954.

C. Line Wire: 18 gauge steel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that the substrate to apply the metal lath framing is free of gaps, protrusions or other foreign objects that would impair the integrity of the stucco membrane. If stucco system will be applied over wood sheathing, verify the sheathing has a 1/8” gap on all edges of every sheet. Do not begin work unless this condition exists.

B. Do not begin until unacceptable conditions have been corrected.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 INSTALLATION - GENERAL

A. Install lath and furring for Portland cement plaster in accordance with the ESR for submitted product and according to manufacturer's recommendations.

3.03 CONTROL AND EXPANSION JOINT INSTALLATION

A. Control Joint Spacing: 8 feet on center vertically, horizontally and otherwise as indicated on drawings..

3.04 LATH INSTALLATION

A. Apply metal lath as per ICC report and as indicated below.

B. Apply lath taut, with long dimension perpendicular to supports.

C. Lap ends minimum 2 inch. Secure end laps with tie wire where they occur between supports.

D. Continuously reinforce internal angles with corner mesh, except where the metal lath returns 3 inches from corner to form the angle reinforcement; fasten at perimeter edges only.

E. Place corner bead at external wall corners; fasten at outer edges of lath only.

F. Place base screeds at termination of plaster areas; secure rigidly in place.

G. Place 4 inch wide strips of lath centered over junctions of dissimilar backing materials, and secure rigidly in place.

H. Place lath vertically above each top corner and each side of door frames to 6 inches above ceiling line.

I. Place casing beads at terminations of plaster finish. Butt and align ends. Secure rigidly in place.

J. Place additional strip mesh diagonally at corners of lathed openings. Secure rigidly in place.

K. Weep Screeds: The #7 FHA flange shall be installed over the first layer on substrate and under the second layer of Grade D paper, running the paper down the 3.5" flange.

L. Horizontal lath: Horizontal lath shall be either flat ribbed metal lath or alternate product complying with ASTM C 847
   1. Structa Wire VTruss Walls & Ceiling, ESR 2017 is an approved alternate

END OF SECTION

Section 09 2400
Cement Plastering

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cement plastering.

1.02 RELATED REQUIREMENTS

A. Section 07 2500 - Weather Barriers: Water-resistive barrier.

B. Section 07 9200 - Joint Sealants

C. Section 09 2236 - Lath: Lath, furring, beads, screeds, and joint accessories for plaster base.

D. Section 09 9113 - Exterior Painting.

1.03 REFERENCE STANDARDS

A. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.

B. ASTM C897 - Standard Specification for Aggregate for Job-Mixed Portland Cement-Based Plasters; 2015 (Reapproved 2020).

C. ASTM C926 - Standard Specification for Application of Portland Cement-Based Plaster; 2024.

1.04 SUBMITTALS

A. See Section 01 3300 - Submittals for submittals procedures.

B. Product Data: Provide data on plaster materials and trim accessories.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.06 FIELD CONDITIONS

A. Exterior Plaster Work: Do not apply plaster when substrate or ambient air temperature is 40 degrees F or lower, or when temperature is expected to drop below 40 degrees F within 48 hours of application.

PART 2 PRODUCTS

2.01 CEMENT PLASTER APPLICATIONS

A. Lath Plaster Base: Metal lath.
   1. Plaster Type: Factory prepared plaster mix.
   2. Number of Coats: Three.
   3. First Coat: Apply to a nominal thickness of 3/8 inch.
   4. Second Coat: Apply to a nominal thickness of 3/8 inch.
   5. Finish Coat: Apply to a nominal thickness of 1/8 inch.
      a. Texture: Sand fine.
   6. Finish: Acrylic.

2.02 FACTORY PREPARED CEMENT PLASTER

A. Exterior Portland cement plaster system made of scratch and brown base coat, leveling coat with reinforcing mesh, and acrylic finish coat; install in accordance with ASTM C926.
   1. Provide weather resistive barrier as part of the system, by the same manufacturer.
   2. Manufacturer - Basis of Design:
      a. LaHabra; FastWall 300: www.lahabrastucco.com/#sle.
      b. Sika Corporation; Parex Armourwall 300: www.parex.com/#sle.
   3. Other Acceptable Manufacturers:
      a. Omega Products International, https://omega-products.com/wall-systems/.

B. Premixed Textured Coating: Polymer modified acrylic coating, integrally colored, and trowel applied to substrates prepared in accordance with manufacturer's written installation instructions.
   1. Color: As indicated on drawings.
   2. Manufacturers:
      a. Parex USA Inc; AquaSol Swirl Fine: www.parex.com
      b. Sto Corp; Powerflex Fine: www.stocorp.com

2.03 ACCESSORIES

A. Lath: See Section 09 2236.

B. Water-Resistive Barrier: See Section 07 2500.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions are acceptable prior to starting this work.

B. Verify lath is flat, secured to substrate, and joint and surface perimeter accessories are properly in place.

3.02 MIXING

A. Mix only as much plaster as can be used prior to initial set.

B. Mix materials dry, to uniform color and consistency, before adding water.

C. Protect mixtures from frost or freezing temperatures, contamination, and excessive evaporation.

3.03 APPLICATION

A. Apply plaster in accordance with manufacturer's written instructions and comply with ASTM C926.

B. Base Coats:
   1. Apply base coat(s) to fully embed lath and to specified thickness.
   2. Follow guidelines in ASTM C926 and manufacturer's written installation instructions for moist curing base coats and application of subsequent coats.

C. Leveling Coat:
   1. Apply leveling coat to specified thickness.
   2. Fully embed reinforcing mesh in leveling coat.

D. Finish Coats:
   1. Cement Plaster or Acrylic Plaster:
      a. Apply with sufficient material and pressure to ensure complete coverage of base to specified thickness.
      b. Apply desired surface texture while mix is still workable.

3.04 TOLERANCES

A. Maximum Variation from True Flatness: 1/4 inch in 10 feet.

3.05 REPAIR

A. Patching: Remove loose, damaged or defective plaster and replace with plaster of same composition; finish to match surrounding area.

END OF SECTION

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Section 09 5100
Acoustical Ceilings

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.02 RELATED REQUIREMENTS

A. Section 08 6223 - Tubular Skylights

B. Section 23 0500 - Common Work Results for Mechanical Systems: Air diffusers in ceiling

C. Section 26 5100 - Interior Lighting

D. Section 28 3100 - Fire Alarm and Detection Systems

1.03 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.

B. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2022.

C. IR 25-2.13 - Metal Suspension System for Lay-In Panel Ceiling; 2017.

D. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2019.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

A. See Section 01 3300 - Submittals for submittal procedures.

B. Product Data: Provide data on suspension system components and acoustical units.

C. Samples: Submit two samples 6 by 6 inch in size illustrating material and finish of acoustical units.

D. Samples: Submit two samples each, 6 inches long, of suspension system main runner, cross runner, and perimeter molding.

E. Maintenance Materials: Furnish the following for District's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Acoustical Units: 80 sq ft of each type and size.

1.06 QUALITY ASSURANCE

A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

B. Before installing canopies, permit them to reach room temperature and a stabilized moisture content.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Tiles/Panels:
   1. Armstrong World Industries, Inc: www.armstrong.com. (Basis of design)
   2. USG Corporation; www.usg.com.
   3. Certainteed

B. Suspension Systems:
   1. Armstrong World Industries, Inc: www.armstrong.com. (Basis of design)
   2. USG Corporation; www.usg.com/ceilings/#sle.
   3. Chicago Metallic

2.02 ACOUSTICAL UNITS

A. Acoustical Panels: Painted mineral fiber, with the following characteristics:
   1. Classification: ASTM E1264 Type III.
   2. Size: 24 by 48 inches as depicted on Drawings.
   3. Thickness: 15/16" inch
   4. NRC Range 0.85 determined in accordance with ASTM E1264.
   5. Ceiling Attenuation Class (CAC): 35 determined in accordance with ASTM E1264.
   6. Panel Edge: Beveled Tegular

7. Suspension System: Exposed
8. Products:
   a. Armstrong High NRC Ultima Beveled Tegular, 15/16", Product #2084

2.03 SUSPENSION SYSTEM(S)

A. Exposed Suspension System: Hot-dip galvanized steel grid and cap.
   1. Structural Classification: Heavy-duty, when tested in accordance with ASTM C635/C635M.
   2. Profile: Tee; 15/16 inch face width.
   3. Finish: Natural Aluminum
   4. Products:
      a. Armstrong Prelude XL 15/16 inch Acoustical Suspension System: https://www.armstrongceilings.com/commercial/en/suspension-systems/prelude-xl-15-16-grid.html
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.04 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.

C. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Installation shall be inconformance with IR 25-2.13

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Locate system on room axis according to reflected plan.

D. Seismic Suspension System, Seismic Design Categories D, E, F: Hang suspension system with grid ends attached to the perimeter molding on two adjacent walls; on opposite walls, maintain a 3/4 inch clearance between grid ends and wall.

E. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

F. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

G. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

H. Do not eccentrically load system or induce rotation of runners.

I. Form expansion joints per approved details. Form to accommodate plus or minus 1 inch movement. Maintain visual closure.

3.03 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

E. Cutting Acoustical Units:
1. Make field cut edges of same profile as factory edges.

3.04 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

Section 09 6500
Resilient Flooring

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient base.

B. Installation accessories.

1.02 RELATED REQUIREMENTS

A. Section 09 0561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

B. Section 09 2116 - Gypsum Board Assemblies.

C. Section 09 6813 - Tile Carpeting.

1.03 REFERENCE STANDARDS

A. ASTM F1861 - Standard Specification for Resilient Wall Base; 2008 (Reapproved 2012).

B. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.

1.04 SUBMITTALS

A. See Section 01 3300 - Submittals, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

1.05 FIELD CONDITIONS

A. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

B. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.01 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; style as scheduled.
   1. Manufacturers:
      a. Burke Flooring: www.burkeflooring.com/#sle.
      b. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.
      c. Flexco; Base 2000; www.flexcofloors.com (Basis of design).
   2. Height: 4 inch.
   3. Thickness: 0.125 inch.
   4. Color: _____Color to be selected in the field from manufacturer's full selection.
   5. Accessories: Premolded external corners and internal corners.

2.02 ACCESSORIES

A. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
   1. Provide only products having lower volatile organic compound (VOC) content than required by the more stringent of the South Coast Air Quality Management District Rule No.1168 and the Bay Area Air Quality Management District Regulation 8, Rule 51.

B. Adhesive for Rubber Flooring:
   1. As recommended by manufacturer..

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

3.02 PREPARATION

A. Prepare substrates as recommended by resilient floor base manufacturers.

B. Remove substrate ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with filler to achieve smooth, flat, hard surface.

C. Prohibit traffic until filler is fully cured.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of substrate conditions.

B. Install in accordance with manufacturer's written instructions.

C. Adhesive-Applied Installation:
   1. Spread only enough adhesive to permit installation of materials before initial set.
   2. Fit joints and butt seams tightly.

3.04 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

3.05 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.06 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

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Section 09 6813
Tile Carpeting

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, fully adhered.

B. Removal of existing carpet tile.

1.02 RELATED REQUIREMENTS

A. Section 01 7419 - Construction Waste Management and Disposal: Reclamation/Recycling of new carpet tile scrap.

B. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied flooring.

C. Section 09 0561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

1.03 REFERENCE STANDARDS

A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016 (Reapproved 2021).

B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2019a, with Editorial Revision (2020).

C. ASTM E662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials; 2021a, with Editorial Revision.

D. CRI 104 - Standard for Installation of Commercial Carpet; 2015.

E. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2023.

1.04 SUBMITTALS

A. See Section 01 3300 - Submittals, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

D. Accessory Samples: Submit two 6 inch long samples of edge strip.

E. Maintenance Materials: Furnish the following for District's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

1.06 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Tile Carpeting - Field:
   1. Interface, Inc; ____: www.interface.com/#sle.
   2. Mannington Commercial: www.manningtoncommercial.com#sle.
   3. Shaw Contract Group; www.shawcontractgroup.com Basis of Design.

2.02 MATERIALS

A. All carpet tile shall be compliant with the provisions of CAL Title 24 P2 Chapter 11B-302.2 Carpet.
   1. Carpet tile shall be securely attached and shall have a firm cushion, pad, or backing, or no cushion or pad.
   2. Carpet tile shall have a level loop, textured loop, level cut pile, or level cut/uncut pile texture.
   3. Pile height shall be 1/2 inch maximum.
   4. Exposed edges of carpet shall be fastened to floor surfaces, and shall have trim on the entire length of the exposed edge.
   5. Carpet trim shall comply with CBC 11B-303.

B. Tile Carpeting, Type CPT-1: Tufted, manufactured in one color dye lot.
   1. Product: Diffuse 24x24 Ecoworx manufactured by Shaw Contract.
   2. Tile Size: match existing

3. Pile Thickness: 0.143 inch.
4. Color: Magnetic Fields 75505.
5. Pattern: Quarter Turn.
6. Flammability: Class I when tested in accordance with ASTM E648 or NFPA 253.
7. Smoke: < 450 when tested in accordance with ASTM E662 NBS smoke chamber.
8. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
9. Gage: 5/64 inch.
10. Stitches: 9.83 per inch.
11. Construction: Tufted tip sheared
12. Yarn: 100% Solution dyed
13. Pile Weight: 20 oz/sq yd.
14. Density Factor: 5035 kilotex.
15. Treatment: Tiles to be treated with soil protective treatment and antimicrobal treatment.
16. Primary Backing Material: GlasBac RE.
17. Total Weight: 20 oz/sq yd.
18. Provide 10% Attic stock.

2.03 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.

B. Edge Strips: Rubber, color as selected by Architect.

C. Adhesives:

D. Carpet Tile Adhesive:
   1. Shaw Loc Dots

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
   1. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.

C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

D. Vacuum clean substrate.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet tile in accordance with manufacturer's instructions.

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay carpet tile in square pattern, with pile direction alternating to next unit, set parallel to building lines.

F. Trim carpet tile neatly at walls and around interruptions.

G. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION

Section 09 9113
Exterior Painting

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Patch and repairing of existing surfaces prior to painting.

D. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
   1. Exposed steel surfaces such as structural steel elements
   2. Exposed galvanized metal surfaces such as sheet metal flashing, vents, and trim.
   3. Exterior cement plaster.

E. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, zinc, copper, and lead.
   6. Floors, unless specifically indicated.
   7. Glass.
   8. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 07 4646 Fiber Cement Siding

B. Section 09 2400 - Portland Cement Plastering

C. Section 09 9123 - Interior Painting.

1.03 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2024.

C. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating; 2023.

D. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.

E. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

F. South Coast Air Quality Management District (SCAQMD) Rule 1113.

G. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

H. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.

I. SSPC-SP 13/NACE No.6 - Surface Preparation of Concrete; 2018.

1.05 SUBMITTALS

A. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").

B. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.

C. Samples: Submit two painted samples, illustrating selected colors and textures for each color and system selected with specified coats cascaded. Submit on aluminum sheet, ____x____ inch in size.

D.

E. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience and approved by manufacturer.

1.07 MOCK-UPS

A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.

B. Provide panel, 4 feet long by ____ feet wide, illustrating paint color, texture, and finish.

C. Locate where directed by Architect.

D. Mock-up may remain as part of the work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.09 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace paint that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: 1 year.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer.

B. Paints:
   1. Dunn-Edwards Corporation; Basis of Design: www.dunnedwards.com/#sle.
   2. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

C. Substitutions: Specified products are a District standard - no substitutions

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Supply each paint material in quantity required to complete entire project's work from a single production run.
   3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:
   1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
      a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
      b. Architectural coatings VOC limits of California.
   2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

D. Colors: As indicated in Color Schedule.
   1. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to District.
   2. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.03 EXTERIOR SCHEDULE - NEW CONSTRUCTION

A. Concrete and plaster:
   1. 1st Coat: Loxon Exterior Acrylic Masonry Primer A24W8300
   2. 2nd Coat: Super-Paint Exterior Acrylic Satin Enamel A89W1151 Series
   3. 3rd Coat: Super-Paint Exterior Acrylic Satin Enamel A89W1151 Series

B. Concrete - curbing:
   1. 1st Coat: Pro-Park Waterborne Traffic Marking Paint B97 Series
   2. 2nd Coat: Pro-Park Waterborne Traffic Marking Paint B97 Series

C. Wood - fascia, eaves and trim:
   1. 1st Coat: Pro-Block Int/Ext Acrylic Primer B51W620 Series

2. 2nd Coat: Super-Paint Exterior Acrylic Satin Enamel A89W1151 Series
3. 3rd Coat: Super-Paint Exterior Acrylic Satin Enamel A89W1151 Series

D. Galvanized Metal - gutter, downspouts, flashing, exposed conduit:
1. Pretreatment: Jasco Metal Prep & Primer
2. 1st Coat: Pro-Cryl Universal Acrylic Metal Primer B66W310 Series
3. 2nd Coat: Sher-Cryl HPA Acrylic Semi-Gloss Coating B66W351 Series
4. 3rd Coat: Sher-Cryl HPA Acrylic Semi-Gloss Coating B66W351 Series

E. Ferrous Metal - doors & frames, structural steel, steel fascia, columns, canopy structures, canopy ceilings and miscellaneous ferrous metal:
1. 1st Coat: Shop applied primer
2. 2nd Coat: Pro-Cryl Universal Acrylic Metal Primer B66W310 Series
3. 3rd Coat: Sher-Cryl HPA Acrylic Semi-Gloss Coating B66W351 Series
4. 4th Coat: Sher-Cryl HPA Acrylic Semi-Gloss Coating B66W351 Series

2.04 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Exterior Plaster and Stucco: 12 percent.
2. Fiber Cement Siding: 12 percent.
3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or repair existing paints or finishes that exhibit surface defects.

D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Concrete:
   1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
   2. Clean surfaces with pressurized water. Use pressure range of 1,500 to 4,000 psi at 6 to 12 inches. Allow to dry.
   3. Repair any spalling or cracking. Allow sufficient time for repairs to cure before painting.
   4. Clean concrete according to ASTM D4258. Allow to dry.
   5. Prepare surface as recommended by top coat manufacturer and in accordance with SSPC-SP 13/NACE No.6.

H. Exterior Plaster: Fill hairline cracks, small holes, and imperfections with exterior patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

I. Galvanized Surfaces:
   1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

J. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning in accordance with SSPC-SP 6/NACE No.3. Protect from corrosion until coated.

K. All surfaces exhibiting mold/mildew shall be treated with a solution of bleach and water. Mix 3 parts clean water with 1 part bleach and apply to effected surfaces. Allow solution to remain on surface for 15 minutes prior to rinsing with clean water.

L. All surfaces to receive paint and all surfaces with the bleach solution shall be pressure washed with a minimum of 2400 psi to remove all loose and peeling paint, mold, mildew, loose/flaky rust, dirt, chalk and any other surface contamination.

M. Any loose and peeling paint, rust and other surface contamination shall be removed with hand or power tool cleaning to a tightly adherent paint film or rusty surface.

N. Glossy surfaces, such as gutters, downspouts, doors, door frames and windows shall be sanded to remove gloss prior to priming.

O. Reset any loose nails at all wood fascia/trim areas.

P. Spot prime rusty nail heads with Rust Destroyer aerosol rust-inhibiting primer prior to priming/finish coating.

Q. Remove all failed sealant and recaulk using NP1 Sealant - exterior application only.

R. Follow all manufacturers' written instructions on application, application temperatures and re-coat times.

3.03 APPLICATION

A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance.

D. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.

E. Mask off and paint metal access doors and other trim located within or adjacent to other surfaces with appropriate paint per schedule above.

F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect adjacent surfaces not being painted.

B. Touch-up damaged finishes after Substantial Completion.

3.06 COLOR SCHEDULE

A. Match existing exterior building colors including field, wainscot, and trim colors. Verify extents prior to bidding.

END OF SECTION

Section 09 9123
Interior Painting

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Prime surfaces to receive wall coverings.
   3. Mechanical and Electrical:
      a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
      b. In finished areas, paint shop-primed items.

D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
   5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.
   6. Floors, unless specifically indicated.
   7. Ceramic and other tiles.
   8. Glass.
   9. Acoustical materials, unless specifically indicated.
   10. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 08 1416 - Wood Doors

C. Section 09 9113 - Exterior Painting.

1.03 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2024.

B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.

C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

D. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

1.05 SUBMITTALS

A. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
   2. Cross-reference to specified paint system products to be used in project; include description of each system.

B. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.
   2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.
   3. Allow 30 days for approval process, after receipt of complete samples by Architect.
   4. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as factory finished metals and wood cabinets, have been approved.

C. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Provide lighting level of 80 fc measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer.

B. Paints:
1. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

C. Substitutions: Specified products are District standard - no substitutions.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
3. Supply each paint material in quantity required to complete entire project's work from a single production run.
4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content: See Section 01 6116.

C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

D. Colors: As indicated on drawings.

1. Allow for minimum of two colors for each system, unless otherwise indicated, without additional cost to District.
2. Extend colors and sheens to surface edges; colors may change at any edge as directed by Architect.
3. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted.

2.03 INTERIOR SCHEDULE - NEW CONSTRUCTION

A. Drywall - walls & ceilings - all areas:
   1. 1st Coat: Pro Mar 200 VOC Interior Acrylic Primer B28W2600.
   2. 2nd Coat: Pro Mar 200 0 VOC Interior Acrylic Semi-Gloss Enamel B31W2651 Series.
   3. 3rd Coat: Pro Mar 200 0 VOC Interior Acrylic Semi-Gloss Enamel B31W2651 Series.

B. Ferrous Metal - doors & frames and miscellaneous ferrous metal:
   1. 1st Coat: Shop applied primer.
   2. 2nd Coat: Pro-Cryl Universal Acrylic Metal Primer B66W310 Series.
   3. 3rd Coat: Sher-Cryl HPA Acrylic Semi-Gloss Coating B66W351 Series.
   4. 4th Coat: Sher-Cryl HPA Acrylic Semi-Gloss Coating B66W351 Series.

C. Galvanized metal - only paint metal 8' and above:
   1. Pretreatment: Jasco Metal Prep & Primer.
   2. 1st Coat: Pro-Cryl Universal Acrylic Metal Primer B66W310 Series.
   3. 2nd Coat: Sher-Cryl HPA Acrylic Semi-Gloss Coating B66W351 Series.
   4. 3rd Coat: Sher-Cyrl HPA Acrylic Semi-Gloss Coating B66W351 Series.

D. Concrete:
   1. 1st Coat: Loxon Int/Ext Acrylic Masonry Primer A24W8300.
   2. 2nd Coat: Pro Mar 200 0 VOC Interior Acrylic Semi-Gloss Enamel B31W2651 Series.
   3. 3rd Coat: Pro Mar 200 0 VOC Interior Acrylic Semi-Gloss Enamel B31W2651 Series.

E. Concrete - floors at utility closets:
   1. 1st Coat: Macropoxy 646 Fast Cure Epoxy B58W610/B58V600 Series.
   2. 2nd Coat: Macropoxy 646 Fast Cure Epoxy B58W610/b58V600 Series.

F. Wood - paint-grade:
   1. 1st Coat: Premium Interior Acrylic Wall & Wood Primer B28W8111.
   2. 2nd Coat: Pro Classic Interior Acrylic Semi-Gloss Enamel B31W1151 Series.
   3. 3rd Coat: Pro Classic Interior Acrylic Semi-Gloss Enamel B31W1151 Series.

2.04 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been adequately prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
   1. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Galvanized Surfaces:
   1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

F. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

G. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

H. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

G. Sand wood and metal surfaces lightly between coats to achieve required finish.

H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

END OF SECTION

Section 10 1400
Signage

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Room identification signs

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry

1.03 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

C. CBC Chapter 11B - California Building Code - Accessibility to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing; 2022.

D. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

E. NFPA 170 - Standard for Fire Safety and Emergency Symbols; 2021.

1.04 SUBMITTALS

A. See Section 01 3300 - Submittals, for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

C. Shop Drawings and Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
   1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
   2. When content of signs is indicated to be determined later, request such information from District through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
   3. Submit for approval by District through Architect prior to fabrication.

D. Samples: Submit one sample of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.

E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.

F. Verification Samples: Submit samples showing colors specified.

1.05 QUALITY ASSURANCE

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store tape adhesive at normal room temperature.

1.07 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flat Signs:
1. Best Sign Systems, Inc: www.bestsigns.com. Basis of Design
2. Mohawk Sign Systems, Inc: www.mohawksign.com/#sle.
3. Seton Identification Products: www.seton.com/aec.

B. Dimensional Letter Signs:
1. Cosco Industries; Cast Aluminum: www.coscoarchitecturalsigns.com
2. A.R.K. Ramos; Cast Aluminum: www.arkramos.com

2.02 SIGNAGE APPLICATIONS

A. Accessibility Compliance: Signs are required to comply with CBC Chapter 11B, ADA Standards, and ICC A117.1, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

B. Room Identification Signs: As indicated on drawings
1. Sign Type: Flat signs with applied character panel media as specified.
2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
3. Character Height: 5/8 inch.
4. Sign Height: 4 inches, unless otherwise indicated.
5. Classrooms: Identify with the room numbers indicated on drawings.

6. Restrooms: Identify as "ALL-GENDER", and duplicate in braille.

C. Restroom Door Plaques: Provide superimposed geometric symbols that comply with applicable requirements of CBC 11B-703.7.2.6 and as indicated on drawings.
   1. Sign Type: Laminated colored acrylic
   2. Non-tactile sign

2.03 SIGN TYPES

A. Flat Signs: Signage media without frame.
   1. Edges: Square.
   2. Corners: Radiused.
   3. Wall Mounting of One-Sided Signs: Stainless steel vandal-proof pin-in-head torx screw surface mounted to wall with concealed anchors.

B. Color and Font: Unless otherwise indicated:
   1. Character Font: Helvetica, Arial, or other sans serif font.
   2. Character Case: Upper case only.
   3. Background Color: As scheduled.
   4. Character Color: White color.

2.04 TACTILE SIGNAGE MEDIA

A. Applied Character Panels: Acrylic plastic base, with applied acrylic plastic letters and braille.
   1. Total Thickness: 1/8 inch.
   2. Letter Thickness: 1/8 inch.
   3. Letter Edges: Square.

2.05 NON-TACTILE SIGNAGE MEDIA

A. Color coated acrylic plastic sheet: Use nonfading colored coatings recommended by acrylic manufacturer for optimum adherence to surface.
   1. Sign Color: #204 Bright White circle; #902 Pine Green triangle
   2. Thickness: 1/4" thick triangle superimposed on a 1/4" thick circle

2.06 ACCESSORIES

A. Exposed Screws: Stainless steel.

B. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Locate signs and mount at heights indicated on drawings and in accordance with CBC Chapter 11B, ADA Standards and ICC A117.1.

D. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

3.03 FIELD INSPECTION

A. Per CBC Chapter 11B signs and identification devices shall be field inspected after installation and approved by the enforcing agency prior to the issuance of a final certificate of occupancy per Chapter 1, Division II, Section 111, or final approval where no certificate of occupancy is issued. The inspection shall include, but not be limited to, verification that Braille dots and cells are properly spaced and the size, proportion and type of raised characters are in compliance with these regulations.

END OF SECTION

Section 10 4400
Fire Protection Specialties

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Roughed in wall openings

1.03 REFERENCE STANDARDS

A. FM (AG) - FM Approval Guide; Current Edition.

B. NFPA 10 - Standard for Portable Fire Extinguishers; 2022.

C. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 01 3300 - Submittals, for submittal procedures.

B. Product Data: Provide extinguisher ratings and classifications and color and finish.

C. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers:
   1. Activar Construction Products Group, Inc. - JL Industries; Cosmic Extinguisher - Multipurpose Chemical: www.activarcpg.com/#sle.
   2. Larsen's Manufacturing Co; MP5 - Basis of Design: www.larsensmfg.com.
   3. Potter-Roemer; 3005: www.potterroemer.com/#sle.

B. Fire Extinguisher Cabinets and Accessories:
   1. Activar Construction Products Group, Inc. - JL Industries; Academy Series: www.activarcpg.com/#sle.

2. Larsen's Manufacturing Co; Architectural Series - Basis of Design: www.larsensmfg.com.
3. Potter-Roemer; Alta Series #7042: www.potterroemer.com.

C. Fire extinguishers and cabinets shall be furnished from single manufacturer.

D. Cabinets shall meet CBC requirements for mounting height and projection from wall.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
1. Stored Pressure Operated: Deep Drawn.
2. Class: A:B:C type.
3. Size: 5 pound.
4. Finish: Baked polyester powder coat red color.
5. Model: MP5 as manufactured by Larsen's
6. Temperature range: Minus 40 degrees F to 120 degrees F.

2.03 FIRE EXTINGUISHER CABINETS

A. Cabinet Configuration: Semi-recessed type.
1. Size to accommodate accessories.
2. Trim: 2-1/2" Rolled edge

B. Door Glazing: Acrylic plastic, clear, 1/8 inch thick, flat shape and set in resilient channel glazing gasket.

C. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

D. Finish of Cabinet Exterior Trim and Door: clear anodized.

E. Finish of Cabinet Interior: Clear anodized aluminum.

F. Lettering: Vertical, Red

G. Model: Larsen's Architectural Series AL 2409-6R Vertical Duo

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, maximum 48" inches from finished floor to top of cabinet pull handle.

END OF SECTION

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Section 22 0500
Common Work Results for Plumbing

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Basic Mechanical Requirements specifically applicable to Division 22 Sections, in addition to the general requirements.

B. Plumbing work includes the following: furnish and install all piping and plumbing fixtures shown on the plumbing, mechanical, and architectural drawings described in these specifications. In connection with this work, contractor shall also furnish and install all necessary work, devices, hardware and systems required to make said systems properly and safely operable, including, but not limited to, support hardware, insulation, valves, flashing, cleanouts, cutting and patching.

1.02 WORK SEQUENCE

A. Install work in phases to accommodate Owner's construction requirements. Refer to Architectural, Structural, and Electrical Drawings for the construction details and coordinate the work of this division with that of other divisions. Order the work of this division so that progress will harmonize with that of other divisions and all work will proceed expeditiously. During the construction period, coordinate mechanical schedule and operations with General Contractor and any other related subcontractor.

B. Coordinate related work and modify surrounding work as required.

1.03 SUBMITTALS

A. Submit on the following:
   1. All pipe, fittings, insulation, hangers and supports, labels, fixtures, adhesives and sealants, and equipment that is planned to be installed on this project.

B. Proposed Products List: Include Products specified in the following Sections:
   1. Division 22 - Plumbing.
   2. Project Drawings.

C. Submit product data grouped to include complete submittals of related systems, products, and accessories in a single submittal bound in a three ring binder with table of contents and section tabs. See General Conditions and other sections for additional submittal requirements. Submittals shall clearly identify electrical characteristics, options provided, color, model number and equipment tag as indicated on the drawings.

D. Equipment and materials shall be ordered only after satisfactory review by Architect and Engineer.

E. The following statement applies to all items reviewed: "Checking is only for general conformance with the design concept of the project and general compliance with the

information given in the contract documents. Any action shown is subject to the requirements of the plans and specifications. Contractor is responsible for dimensions which shall be confirmed at the job site; fabrication processes and techniques of construction; coordination of his work with that of other trades; and the satisfactory performance of his work."

F. Maintain a complete set of the most current reviewed submittal and shop drawings on site during construction.

G. The first submittal shall be comprehensive and complete. Partial submittals will be returned without review.

1.04 REGULATORY REQUIREMENTS

A. Conform to 2022 California Building Code.

B. Fire Protection: Conform to 2022 California Fire Code, and California State Fire Marshall Regulations, Title 19, Public Safety.

C. Plumbing: Conform to 2022 California Plumbing Code.

D. Mechanical: Conform to 2022 California Mechanical Code.

E. Electrical: Conform to 2022 California Electrical Code.

F. Obtain approved inspections from authority having jurisdiction.

G. Conflicts: Where conflict or variation exists amongst Codes, the most stringent shall govern.

1.05 PROJECT / SITE CONDITIONS

A. Install work in locations shown on drawings, unless prevented by project conditions.

B. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other Sections. Obtain permission of Owner before proceeding.

C. Piping Locations: Piping locations shown are diagrammatic only. Contractor shall verify locations of all lateral stubs, offsets, etc. required in the field. The actual locations of lines, cleanouts and connections may vary provided that complete systems are installed in compliance with codes.

D. Construction Observation: In addition to the requirement for obtaining inspections by the local jurisdiction, Contractor shall notify Engineer and commissioning agent at appropriate times during the construction process so that they can visit site to become generally familiar with the progress and quality of Contractor's work and to determine if the work is proceeding in general accordance with the contract documents.

E. Scaling of Drawings: In no case shall working dimensions be scaled from plans, sections, or details from the working drawings. If no dimension is shown on the architectural drawings, the prime Contractor shall request in writing that the Architect or the Engineer provide clarification or the specific dimension.

1.06 QUALITY ASSURANCE

A. Qualification of Manufacturer: Products used in work shall be produced by manufacturers regularly engaged in the manufacture of similar items.

B. Qualification of Installer: Use adequate number of skilled workmen, thoroughly trained and experienced in the necessary crafts, and completely familiar with the specified requirements contained in the plans and specifications.

C. Applicable equipment and materials to be listed by Underwriters' Laboratories and manufactured in accordance with ASME, AWWA, or ANSI standards. Power-using equipment shall meet the California energy efficiency standards as defined in the current Title 24 requirements.

D. Welding procedures and testing shall comply with ANSI Standard B31.1.0 standard code for pressure piping and the American Welding Society – Welding Handbook. Welding shall also comply with Division of the State Architect and structural plan requirements for materials, procedures, qualifications, and inspections.

1.07 DRAWINGS AND SPECIFICATIONS

A. Drawings and specifications are intended to complement each other. Where a conflict exists between the requirements of the drawings and/or specifications, the contractor shall immediately and before commencing work, request clarification from Engineer.

B. The Engineer shall interpret the drawings and the specifications, and the Engineer's decision as to the true intent and meaning thereof and the quality, quantity, and the sufficiency of the materials and workmanship furnished there under shall be accepted as final and conclusive.

C. In case of conflicts not clarified prior to bidding deadline, use the most costly alternative (better quality, greater quantity, or larger size) in preparing the Bid. A clarification will be issued to the successful Bidder as soon as feasible after the Award, and if appropriate a deductive change order will be issued.

D. All provisions shall be deemed mandatory except as expressly indicated as optional by the word "may" or "option".

E. Examine and compare the contract drawings and specifications with the drawings and specifications of other trades. Report any discrepancies to the architect. Install and coordinate the work in cooperation with the other trades.

1.08 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

PART 2 - PRODUCTS

2.01 PRODUCTS

A. Maintain uniformity of manufacturer for equipment used in similar applications and sizes.

B. Provide products and materials that are new, clean, free from defects, damage, and corrosion.

C. Provide name/data plates on major components with manufacturer's name, model number, serial number, date of manufacturer, capacity data, and electrical characteristics permanently attached in a conspicuous location on the equipment.

D. Protect materials stored at site and installed from damage. Verify dimensions of equipment and fixtures prior to ordering. Install all equipment per the manufacturer's instructions for installing, connecting, and adjusting. A copy of the instructions shall be kept at the equipment during installation and provided to the engineer at his/her request.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install all equipment per the manufacturer's instructions for installing, connecting, and adjusting. A copy of the instructions shall be kept at the equipment during installation and provided to the engineer at his/her request.

B. Adjust pipes, ducts, panels, equipment, etc., to accommodate the work to prevent interferences. Provide offsets as needed to avoid other trades.

1. Right-of-Way: Lines which pitch have the right-of-way over those which do not pitch. Lines whose elevations cannot change have right-of-way over lines whose elevations can be changed.
2. Provide offsets, transitions, and changes in directions of pipes as required to maintain proper head room and pitch on sloping lines. Provide traps, air vents, drains, etc., as required. It is the intent of this paragraph that all cost associated with compliance be borne by the contractor.
3. All equipment shall be firmly anchored to building structural elements per DSA approved plans.
4. Carefully check space requirements with other trades and existing conditions to ensure material, fixtures or equipment can be installed in the spaces allotted. Coordination is required and essential.

3. 2 FIRESTOPPING

A. Firestop all penetrations of rated elements with approved firestop material such as Hilti FS-1 per manufacturer's plates. Provide plates to project inspector prior to installation.

END OF SECTION

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Section 22 0510
Plumbing Piping

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, notes, and general provisions of the Contract, including General and Supplemental Conditions apply to this section.

1.02 SUMMARY

A. Section Includes:
1. Pipe and fittings for Condensate.
2. Escutcheons.

1.03 REFERENCES

A. ANSI B31.9 - Building Service Piping.

B. ASME B16.3 - Malleable Iron Threaded Fittings.

C. ASME B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings.

D. ASTM A47 - Ferritic Malleable Iron Castings.

E. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.

F. ASTM A74 - Cast Iron Soil Pipe and Fittings.

G. ASTM A120 - Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized), Welded and Seamless, for Ordinary Uses.

H. ASTM B32 - Solder Metal.

I. ASTM B88 - Seamless Copper Water Tube.

J. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

K. ASTM D1785 - Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120.

L. ASTM D2241 - Poly Vinyl Chloride (PVC) Plastic Pipe (SDR-PR).

M. ASTM D2466 - Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40.

N. ASTM D2564 - Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings.

O. ASTM D2855 - Making Solvent-Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings.

P. ASTM D3034 - Poly Vinyl Chloride (PVC) Plastic Sewer Pipe SDR-35.

Q. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems.

R. CISPI 310 - Joints for Hubless Cast Iron Sanitary Systems.

S. ASTM D2513 - SDR11.5 Polyethylene Gas Pipe.

1.04 SUBMITTALS

A. Product Data: For the following products:
   1. Piping and fittings.
   2. Escutcheons.

B. Project Record Documents
   1. Submit the following:
   2. Record actual locations of valves and piping.

C. Operation and Maintenance Data
   1. Submit the following:
   2. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.05 REGULATORY REQUIREMENTS

A. Perform Work in accordance with 2022 California plumbing code.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of the general requirements.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. 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 CONDENSATE PIPING

A. Hard Copper Tube: ASTM B88, Type L water tube, drawn temper. US – Manufactured.

1. Wrought-copper solder-joint fittings: ASME B16.22, wrought-copper pressure fittings, with lead-free solder.
2. Bronze Flanges: ASME B16.24, class 150, with solder-joint ends.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
4. Insulate interior condensate piping.

2.02 ESCUTCHEONS

A. Escutcheons for water and waste piping penetrations.

1. Manufacturers: subject to compliance with requirements, provide products by the following: Brasscraft.
2. Description: chrome-plated cast brass with set screws.

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.

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.

D. Install piping to conserve building 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.

G. Provide clearance for installation of insulation and access to valves and fittings.

H. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors.

I. Prepare pipe, fittings, supports, and accessories not pre-finished, ready for finish painting.

J. Seal all penetrations through exterior walls and fire rated walls with 3M Firestopping materials for fire rating capacity per the architectural plans and UBC requirements.

K. Test all piping per 2022 California Plumbing Code Requirements.

L. As-built locations of pipe with dimensions from easily identified building elements.

3.04 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe.

3.05 ERECTION TOLERANCES

A. Establish invert elevations, slopes for drainage to 1/8 inch per foot minimum. Maintain gradients.

B. Slope condensate piping and arrange to drain at low points.

END OF SECTION

Section 22 0529
Hangers and Supports for Plumbing Piping and Equipment

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following hangers and supports for plumbing system piping and equipment:
   1. Steel pipe hangers and supports.
   2. Trapeze pipe hangers.
   3. Metal framing systems.
   4. Thermal-hanger shield inserts.
   5. Fastener systems.
   6. Pipe stands.
   7. Equipment supports.

1.03 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."

1.04 PERFORMANCE REQUIREMENTS

A. Equipment supports shall be capable of supporting combined operating weight of supported equipment and connected systems and components.

B. Design seismic-restraint hangers and supports for piping and equipment per 2008 SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems. Hazard level is "A."

C. All exterior steel support components shall be hot-dipped galvanized. All welds shall be ground smooth and painted with three coats of zinc-rich paint.

1.05 SUBMITTALS

A. Product Data: For the following:
   1. Steel pipe hangers and supports.
   2. Thermal-hanger shield inserts.
   3. Mechanical fastener systems.
   4. Pipe positioning systems.

5. Trapeze pipe hangers. Include Product Data for components.
6. Metal framing systems. Include Product Data for components.
7. Pipe stands. Include Product Data for components.
8. Equipment supports.

B. Welding certificates.

1.06 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel." Welding: Qualify procedures and personnel according to the following:
1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
4. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the 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. Manufacturers:
1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.
3. Unistrut
4. Superstrut

C. Galvanized, Metallic Coatings: Hot dipped.

D. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.03 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.
1. Manufacturers:

a. B-Line Systems, Inc.; a division of Cooper Industries.

b. Unistrut Corp.; Tyco International, Ltd.

2.04 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers:
1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. Power-Strut Div.; Tyco International, Ltd.
4. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated. Exterior components shall be hot-dipped galvanized.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.05 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

B. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

C. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

D. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

E. Provide submittal.

2.06 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated (interior use) Type 304 stainless steel (exterior use), for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Anchor must have ICC report. Provide report with submittal and one copy to the inspector. See State Architect Requirements for testing.
1. Manufacturers:

a. Hilti, Inc.
b. ITW Ramset/Red Head.
c. Or equal.

C. Pre- placed concrete inserts

1. Manufacturers:

    a. B-Line Systems, Inc.; a division of Cooper Industries.
    b. or equal.

2.07 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping. See plans for details.

B. All exterior steel supports shall be hot dipped galvanized.

C. No piping supports shall be mounted directly on roof membrane.

2.08 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.09 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized. All exterior steel supports shall be hot dipped galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
    1. Properties: Nonstaining, noncorrosive, and nongaseous.
    2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.01 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 piping that is subject to scratching.

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. 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 above for individual pipe hangers.
   2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:
   1. Install concrete inserts prior to concrete placement per manufacturer's listing.
   2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:

G. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface.

H. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

J. 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.

K. Install lateral bracing with pipe hangers and supports to prevent swaying.

L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, 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.

M. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

O. Insulated Piping: Comply with the following:
   1. Attach clamps and spacers to piping.
      a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
      b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
      c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.

   2. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
      a. 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. Shield Dimensions for Pipe: Not less than the following:
      a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

   4. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.03 EQUIPMENT SUPPORTS

A. Provide 20 gauge sheet metal backing as needed to support equipment and fixture.

3.04 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports or 4x between framing with Simpson A-34 clips at each side, both ends..

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.05 ADJUSTING & PERSONNEL PROTECTION

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 1/2 inches below nut.

C. Provide personnel protection at mechanical rooms, equipment areas and any equipment maintenance area from strut and threaded rods ends. Install soft protective materials to prevent skin and skull injuries. Install protection as soon as practicable after installation.

3.06 PAINTING

A. Touch Up: Clean and touch up painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

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Section 22 0700
Plumbing Insulation

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Insulation Materials:
    a. Glass fiber.

B. Related Sections include the following:
1. Section 22 05 10 - Plumbing Piping.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.06 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.07 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements,

    a. Fibrex Insulations Inc.; Coreplus 1200.
    b. Johns Manville; Micro-Lok.
    c. Knauf Insulation; 1000(Pipe Insulation.
    d. Manson Insulation Inc.; Alley-K.
    e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

    a. RPR Products, Inc.; Insul-Mate.

2.02 GLASS FIBER

A. Manufacturers:

1. Owens Corning.
2. Johns-Manville.
3. Or equal.

B. Insulation: ASTM C547; rigid molded, noncombustible.

1. 'K' ('ksi') value: ASTM C335, 0.24 at 75 degrees F (0.035 at 24 degrees C).
2. Minimum Service Temperature: -20 degrees F (-28.9 degrees C).
3. Maximum Service Temperature: 300 degrees F (150 degrees C).
4. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket

1. ASTM C921, White kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Transmission: ASTM E96; 0.02 perm inches.
3. Secure with self-sealing longitudinal laps and butt strips.
4. Secure with outward clinch expanding staples and vapor barrier mastic.

D. Tie Wire: 18 gage stainless steel with twisted ends on max. 12 inch (300 mm) centers.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.03 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

1. All sealants and adhesives to be field-applied, within the building envelope must comply with VOC limits.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.04 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

3.05 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and

unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

6. All sealants and adhesives to be field-applied, within the building envelope must comply with state and local VOC limits.
7. Install pipe insulation that is suitable to be painted. Paint all exposed pipes, insulation, and all piping supports to match adjacent surface. Verify color with school district. See painting specifications.

3.06 GLASS FIBER INSULATION SCHEDULE

PIPING SYSTEMS	PIPE SIZE Inch (mm)	THICKNESS Inch (mm)
Concealed condensate	3/4”	1”

END OF SECTION

Section 23 0500
Common Work Results for HVAC

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Basic Mechanical Requirements specifically applicable to Division 23 Sections, in addition to the General Requirements.

B. Mechanical work includes the following: furnish and install all mechanical equipment shown on the mechanical, plumbing, architectural, electrical, and civil engineering drawings and described in these specifications. Contractor shall furnish and install, make operable, and test all mechanical equipment shown on the plans. In connection therewith, contractor shall also furnish and install all necessary work, devices, hardware and systems required to make said equipment properly and safely operable, including but not limited to, mounting hardware and framing, insulation, vibration control devices, duct systems, flashing, piping, valves, systems, energy management systems, cutting and patching.

1.02 WORK SEQUENCE

A. Install work in phases to accommodate Owner's construction requirements. Refer to Architectural, Structural, Civil, and Electrical Drawings for the construction details and coordinate the work of this division with that of other divisions. Order the work of this division so that progress will harmonize with that of other divisions and all work will proceed expeditiously. During the construction period, coordinate mechanical schedule and operations with General Contractor and any other related subcontractor.

1.03 ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at the Owner's option. Accepted Alternates will be identified in Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work as required.

1.04 SUBMITTALS

A. Submit the following:

B. Proposed Products List: Include Products specified in the following Sections:

1. Section 23 - Mechanical.

2. Project Drawings

C. Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in a single submittal. Submittals shall be specific to the

fixtures/device/unit being submitted; the data shall be highlighted or marked to be quite clear as to the fixtures/devices/units that shall be provided.

D. Equipment and materials shall be ordered only after satisfactory review by Owner and Engineer.

E. The following statement applies to all items reviewed. "Checking is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Any action shown is subject to the requirements of the plans and specifications. Contractor is responsible for dimensions which shall be confirmed at the job site; fabrication processes and techniques of construction; coordination of his work with that of other trades; and the satisfactory performance of his work."

F. Contractor shall clearly mark the submittal sheet as to which model number, size, color, etc. when there is more than one choice available.

G. Maintain a complete set of the most current reviewed submittal and shop drawings on site during construction.

H. Submittals shall have table of contents organized by specification section and shall clearly identify electrical characteristics, options provided, color, model number and equipment tag as indicated on the drawings.

1.05 REGULATORY REQUIREMENTS

A. Conform to 2022 California Building Code.

B. Fire Protection: Conform to 2022 California Fire Code, and California State Fire Marshall Regulations, Title 19, Public Safety.

C. Plumbing: Conform to 2022 California Plumbing Code.

D. Mechanical: Conform to 2022 California Mechanical Code.

E. Electrical: Conform to 2022 California Electrical Code.

F. Obtain approved inspections from authority having jurisdiction.

G. Conflicts: Where conflict or variation exists amongst Codes, the most stringent shall govern.

1.06 PROJECT/SITE CONDITIONS

A. Install work in locations shown on drawings, unless prevented by project conditions.

B. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other Sections. Obtain permission of owner before proceeding.

C. Piping locations: Piping locations shown are diagrammatic only. Contractor shall verify locations of all lateral stubs, offsets, etc. required in the field. The actual locations of lines, cleanouts and connections may vary provided that complete systems are installed in compliance with codes. It is not the intent of the drawings to show necessary offsets required to avoid structure or other trades. It is the intent of this paragraph that all costs associated with this paragraph be borne by the contractor.

D. Construction observation: In addition to the requirement for obtaining inspections by the local jurisdiction, contractor shall notify Engineer at appropriate times during the construction process so that Engineer can visit site to become generally familiar with the progress and quality of contractor's work and to determine if the work is proceeding in general accordance with the contract documents.

E. Scaling of drawings: In no case shall working dimensions be scaled from plans, sections, or details from the working drawings. If no dimension is shown on the architectural drawings, the prime contractor shall request in writing that the architect or engineer provide clarification or the specific dimension.

F. As equal: For an item to be substituted "as equal" the contractor must provide to the engineer a complete submittal no later than 7 days prior to the bid opening. Contractor shall be responsible for any cost associated with the change including architectural design, mechanical, structural and electrical engineering and changes in any element of the building.

G. Unit and duct locations: Heating and air conditioning unit and duct locations shown are approximate only. Contractor shall verify locations of all structural members, other trades, and existing conditions in the field, and locate units and ductwork to avoid interference. All clearances required by unit manufacturer shall be maintained. Entire installation shall be in accordance with codes and the recommended installation procedures published by the manufacturers. It is not the intent of the drawings to show necessary offsets and transitions required to avoid structure or other trades. It is the intent of this paragraph that all costs associated with this paragraph be borne by the contractor.

H. Contractor will verify with owner and site conditions the exact existing roofing system in place and provide compatible roofing materials and products. Contractor to provide written statement regarding existing roofing system and proposed roofing system and provide manufacturer information prior to procurement and installation.

I. Proceed with roofing work only when existing and forecasted weather conditions will permit a unit of work to be installed in accordance with manufacturer’s recommendations and warranty requirements.

J. Flashings and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Complete flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

K. Patching Materials, General: As required for original installation and to match surrounding construction.

1. Contractor shall provide same products or types of construction as that in existing structure, as needed to patch, extend or match existing.
2. Generally, the Contract Documents will not define products or standards of workmanship present in existing construction. Contractor shall determine products by inspection and necessary testing and determine quality of workmanship by using existing as a sample for comparison.
3. The presence of a product, finish, or type of construction requires that patching, extending or matching shall be performed as necessary to make work complete and consistent with identical standards of quality.

L. Patching of Building Finish Materials: Contractor shall match existing products and finishes. Contractor shall confirm colors, patterns, and textures with Architect/Owner. The contractor shall custom cut new materials to fit and to match joint patterns with existing materials. The contractor shall custom cut new materials to size to match existing constructions.

M. Patching of Roof: Contractor shall patch and match existing adjacent surface. Where penetrations have occurred to finish surface to remain, contractor shall patch penetrations and repair. Restore exposed finishes of patch areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing. All shall be performed by a licensed roofing contractor.

1.07 QUALITY ASSURANCE

A. Qualification of Manufacturer: Products used in work shall be produced by manufacturers regularly engaged in the manufacture of similar items.

B. Qualification of Installer: Use adequate number of skilled workman, thoroughly trained and experienced in the necessary crafts, and completely familiar with the specified requirements contained in the plans and specifications. Engage an experienced installer to perform work who has specialized in installing roofing similar to that required for this project; who is approved, authorized, or licensed by the roofing system manufacturer to install manufacturer's product; and who is eligible to receive the standard roofing manufacturer's warranty.

C. Maintain uniformity of manufacturer for equipment used in similar applications and sizes.

D. Provide products and materials that are new, clean, free from defects, damage, and corrosion.

E. Provide name/data plates on major components with manufacturer's name, model number, serial number, date of manufacturer, capacity data, and electrical characteristics permanently attached in a conspicuous location on the equipment.

F. Applicable equipment and materials to be listed by Underwriters' Laboratories and manufactured in accordance with ASME, AWWA, or ANSI standards. Power using equipment shall be meet the California energy efficiency standards as defined in the current Title 24 requirements.

1.08 DRAWINGS AND SPECIFICATIONS

A. Drawings and specifications are intended to complement each other. Where a conflict exists between the requirements of the drawings and/or specifications, immediately and before commencing work, request clarification from Engineer.

B. The Engineer shall interpret the drawings and the specifications, and the Engineer's decision as to the true intent and meaning thereof and the quality, quantity, and sufficiency of the materials and workmanship furnished thereunder shall be accepted as final and conclusive.

C. In case of conflicts not clarified prior to Bidding deadline, use the most costly alternative (better quality, greater quantity, or larger size) in preparing the Bid. A clarification will be issued to the successful Bidder as soon as feasible after the Award and if appropriate a deductive change order will be issued.

D. All provisions shall be deemed mandatory except as expressly indicated as optional by the word "may" or "option".

E. Examine and compare the contract drawings and specifications with the drawings and specifications of other trades. Report any discrepancies to the architect. Install and coordinate the work in cooperation with the other trades.

PART 2 – NOT USED

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install all equipment per the manufacturer's instructions for installing, connecting, and adjusting. A copy of the instructions shall be kept at the equipment during installation and provided to the engineer at his/her request.

B. Adjust pipes, ducts, panels, equipment, etc., to accommodate the work to prevent interferences.

1. Right-of-Way: Lines which pitch have the right-of-way over those which do not pitch. Lines whose elevations cannot change have right-of-way over lines whose elevations can be changed.

2. Provide offsets, transitions, and changes in directions of pipes and ducts as required to maintain proper head room and pitch on sloping lines. Provide traps, air vents, drains, etc., as required.

C. All equipment shall be firmly anchored to building structural elements.

D. Install all equipment to permit proper service of equipment. Arrange pipes, ducts, conduits, etc to allow accessibility to equipment.

E. Do not install equipment, pipes, or ducts above electrical room

F. Install accessible plumbing fixtures at height shown on architectural drawings. Report any discrepancies or layout issues to Architect promptly.

3.02 COORDINATION OF WORK

A. The contract documents establish scope, materials, and quality but are not detailed installation instructions. Drawings are diagrammatic.

B. The contract documents show the general arrangement of equipment, ductwork, piping, and accessories. Provide offsets, fittings, and accessories which may be required but are not shown on the drawings. Investigate the site and review the other trades installation locations and requirements to determine conditions affecting the work and provide such work and accessories as may be required to accommodate such conditions.

C. Whenever work interconnects with the work of other trades, coordinate to insure that all parties concerned have the necessary information required for a proper installation.

D. Provide access doors as required to allow service and accessibility to valves, dampers, coils, etc. Install fire rated access doors in rated assemblies. Coordinate with framing and ceiling contractors.

E. Furnish and set sleeves for passage of pipes, ducts, and conduits that pass through structural masonry and concrete walls, roofs, floors and elsewhere as required for the proper protection of each item passing through the building elements. See structural drawings for further details.

F. Install UL Approved firestopping around all pipes, conduits, ducts, etc which pass through rated walls, partitions, and floors in strict accordance with manufacturer's listing and element rating.

3.03 OPERATING INSTRUCTIONS AND OPERATOR TRAINING

A. Provide two copies of all operating and maintenance manuals to owner. Include parts lists and suppliers' names and phone numbers.

B. Provide four hours of training to the owner for the proper operation (start-up, operation, and shutdown) and servicing of the installed equipment. Provide three weeks notice to the owner and engineer of the date of the training. Arrange for subcontractors to attend and participate where applicable.

3.04 RECORD DRAWINGS

A. Maintain on a daily basis at the project site a complete set of record drawings reflecting an accurate dimensional record of all deviations between work shown on the drawing and that actually installed.

B. Show any changes to specified equipment such as manufacturer, voltage, model number, capacity, etc. on record drawings.

C. Provide two reproducible copies of the record drawing to the owner.

3.05 COMMISSIONING

A. At the conclusion of the installation the contractor shall convene a pre-commissioning meeting to review the implementation of the commissioning process.

B. Contractor shall verify that all building services, gas, electric, water, sewer, and information technologies are functional prior to beginning commissioning.

C. Immediately correct roof leakage during construction. If the Contractor does not respond within twenty four (24) hours, the owner will exercise right to correct the Work under terms of the Construction of the Contract.

D. The commissioning team shall comprise the general, mechanical, electrical, controls and plumbing contractors, the project manager, test and balance company, and the mechanical engineer. Provide sample forms for review to the mechanical engineer prior at pre-commissioning meeting.

E. The commissioning process shall be including function testing all equipment, controls, natural gas, and electrical systems. All testing shall be documented in an item by item report with dates of test, test parameters and results.

F. Provide commissioning report to project manager within two weeks of completion.

END OF SECTION

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Section 23 0529
Hangers and Supports for HVAC Equipment

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following hangers and supports for HVAC system piping and equipment:

1. Metal framing systems.
2. Fastener systems.
3. Equipment supports.

B. Related Sections include the following:

1. Division 23 Section(s) “Metal Ducts" for duct hangers and supports.

1.03 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."

1.04 PERFORMANCE REQUIREMENTS

A. Design seismic-restraint hangers and supports for piping and equipment per 2008 SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems. Hazard level is “A.”

1.05 SUBMITTALS

A. Product Data: For the following:

1. Strut and fittings.
2. Fasteners.

1.06 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
5. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. B-Line Systems, Inc.; A Division of Cooper Industries.
2. ERICO/Michigan Hanger Co.

C. Galvanized, Metallic Coatings: Pre-galvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Refrigerant Pipe Support Options:
1. EPDM clamp insert at all pipe clamps at refrigerant piping.
2. Strut Mount Insulation Couplings (Hydra Zorb Klo Shure 7 Series or similar)

2.03 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.04 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: At Interior - Manufacturer's standard finish – At exterior - Hot dipped galvanized.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.05 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type interior/exterior steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used. Install per ICC listing.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hilti, Inc.
b. ITW Ramset/Red Head.

C. Wood Screws for secure pipe and duct supports to wood structure

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Simpson SDS Screws
b. or equal with self drilling feature and ICC report

D. Sheet Metal Screws

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. TEK Screws
b. or equal with self drilling feature and ICC report

2.06 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.07 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized. All exterior steel shall be hot dipped aluminized.

PART 3 - EXECUTION

3.01 HANGER AND SUPPORT APPLICATIONS

A. Use hangers and supports with hot dipped galvanized, at exterior locations.

B. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system sections, install the following types:

1. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
2. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

C. Saddles and Shields: Unless otherwise indicated and except as specified in piping system sections, install the following types:

1. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

D. Use mechanical-expansion anchors where required in concrete construction.

3.02 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

C. 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.

D. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

E. 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.

F. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

G. All pipes and ducts shall be braced per 2008 SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems. Seismic hazard level is "A".

3.03 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Provide lateral bracing, to prevent swaying, for equipment supports.

C. Anchor all equipment to resist seismic motion.

3.04 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.05 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.

3.06 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces. If material is galvanized spray with cold galvanizing.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply three costs of galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

Section 23 0593
Testing, Adjusting, and Balancing for HVAC

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.

1.03 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, Adjusting, and Balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.04 SUBMITTALS

A. Certified TAB reports.

B. Sample report forms.

C. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.05 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC, NEBB, or TABB.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC, NEBB or TABB.
2. TAB Technician: Employee of the TAB contractor and who is certified by AABC, NEBB or TABB as a TAB technician.

B. TAB Conference: Meet with Engineer on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items:

a. The Contract Documents examination report.
b. The TAB plan.
c. Coordination and cooperation of trades and subcontractors.
d. Coordination of documentation and communication flow.

C. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

D. TAB Report Forms: Use standard TAB contractor's forms approved by Engineer.

E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.06 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 Section "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible, and their controls are connected and functioning.

K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine system pumps to ensure absence of entrained air in the suction piping.

O. Examine operating safety interlocks and controls on HVAC equipment.

P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.02 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures where applicable.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", ASHRAE 111, NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", or SMACNA's "HVAC Systems – Testing, Adjusting, and Balancing" and in this Section.

1. Comply with requirements in ASHRAE 62.1-2004, Section 7.2.2, "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Division 23 Section "Air Duct Accessories."
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

3.05 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

    a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

    a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
    b. Measure static pressure directly at the fan outlet or through the flexible connection.
    c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
    d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and –treating equipment.

a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Adjust using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.06 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

3. Manufacturer's name, model number, and serial number.
4. Motor horsepower rating.
5. Motor rpm.
6. Efficiency rating.
7. Nameplate and measured voltage, each phase.
8. Nameplate and measured amperage, each phase.
9. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.07 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.
3. Heating-Water Flow Rate: Plus or minus 10 percent.
4. Cooling-Water Flow Rate: Plus or minus 10 percent.

3.08 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.09 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.

2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
10. Report date.
11. Signature of TAB supervisor who certifies the report.
12. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
13. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

14. Nomenclature sheets for each item of equipment.
15. Data for terminal units, including manufacturer's name, type, size, and fittings.
16. Notes to explain why certain final data in the body of reports vary from indicated values.
17. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches, and bore.
    i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
    j. Number, make, and size of belts.
    k. Number, type, and size of filters.

2. Motor Data:

    a. Motor make, and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches, and bore.
    f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

    a. Total air flow rate in cfm.
    b. Total system static pressure in inches wg.
    c. Fan rpm.
    d. Discharge static pressure in inches wg.
    e. Filter static-pressure differential in inches wg.
    f. Preheat-coil static-pressure differential in inches wg.
    g. Cooling-coil static-pressure differential in inches wg.
    h. Heating-coil static-pressure differential in inches wg.
    i. Outdoor airflow in cfm.
    j. Return airflow in cfm.
    k. Outdoor-air damper position.
    l. Return-air damper position.

m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft..
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Water flow rate in gpm.
i. Water pressure differential in feet of head or psig.
j. Entering-water temperature in deg F.
k. Leaving-water temperature in deg F.
l. Refrigerant expansion valve and refrigerant types.
m. Refrigerant suction pressure in psig.
n. Refrigerant suction temperature in deg F.
o. Inlet steam pressure in psig.

G. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Fuel type in input data.
g. Output capacity in Btu/h.

h. Ignition type.
i. Burner-control types.
j. Motor horsepower and rpm.
k. Motor volts, phase, and hertz.
l. Motor full-load amperage and service factor.
m. Sheave make, size in inches, and bore.
n. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm.
b. Entering-air temperature in deg F.
c. Leaving-air temperature in deg F.
d. Air temperature differential in deg F.
e. Entering-air static pressure in inches wg.
f. Leaving-air static pressure in inches wg.
g. Air static-pressure differential in inches wg.
h. Low-fire fuel input in Btu/h.
i. High-fire fuel input in Btu/h.
j. Manifold pressure in psig.
k. High-temperature-limit setting in deg F.
l. Operating set point in Btu/h.
m. Motor voltage at each connection.
n. Motor amperage for each phase.
o. Heating value of fuel in Btu/h.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft..
g. Indicated air flow rate in cfm.
h. Indicated velocity in fpm.
i. Actual air flow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

J. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Apparatus used for test.
d. Area served.
e. Make.
f. Number from system diagram.
g. Type and model number.
h. Size.
i. Effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Air velocity in fpm.
c. Preliminary air flow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.

e. Final air flow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

K. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:

a. System and air-handling-unit identification.
b. Location and zone.
c. Room or riser served.
d. Coil make and size.
e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Entering-water temperature in deg F.
c. Leaving-water temperature in deg F.
d. Water pressure drop in feet of head or psig.
e. Entering-air temperature in deg F.
f. Leaving-air temperature in deg F.

L. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Service.
d. Make and size.
e. Model number and serial number.
f. Water flow rate in gpm.
g. Water pressure differential in feet of head or psig.
h. Required net positive suction head in feet of head or psig.
i. Pump rpm.
j. Impeller diameter in inches.
k. Motor make and frame size.
l. Motor horsepower and rpm.
m. Voltage at each connection.
n. Amperage for each phase.
o. Full-load amperage and service factor.
p. Seal type.

2. Test Data (Indicated and Actual Values):

a. Static head in feet of head or psig.
b. Pump shutoff pressure in feet of head or psig.
c. Actual impeller size in inches.
d. Full-open flow rate in gpm.
e. Full-open pressure in feet of head or psig.
f. Final discharge pressure in feet of head or psig.
g. Final suction pressure in feet of head or psig.
h. Final total pressure in feet of head or psig.
i. Final water flow rate in gpm.
j. Voltage at each connection.
k. Amperage for each phase.

M. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.10 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.

2. Check the following for each system:

a. Measure airflow of at least 10 percent of air outlets.
b. Measure water flow of at least 5 percent of terminals.
c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
d. Verify that balancing devices are marked with final balance position.
e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Engineer.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Engineer.

3. Engineer shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make any adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

END OF SECTION

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SECTION 23 0700
HVAC INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Insulation Materials:

    a. Flexible elastomeric.
    b. Mineral fiber.

2. Adhesives.
3. Sealants.
4. Field-applied jackets.
5. Tapes.
6. Securements.

B. Related Sections:
1. Division 22 Section "Plumbing Insulation."
2. Division 23 Section “Metal Ducts” for duct liners.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Shop Drawings:

C. Qualification Data: For qualified Installer.

D. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

E. Field quality-control reports.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.06 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.07 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 GLASS FIBER, FLEXIBLE

A. Manufacturers:

1. Johns Manville Microlite
2. Knauf PermaWick
3. Or equal.

B. Insulation: ASTM C553 C612; flexible, noncombustible blanket.

1. 'K' ('Ksi') value: ASTM C518, 0.29 at 75 degrees F (0.042 at 24 degrees C).
2. Maximum service temperature: 250 degrees F (121 degrees C).
3. Maximum moisture absorption: 0.20 percent by volume.

C. Vapor Barrier Jacket

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film 0.0032 inch (0.081 mm) vinyl.
2. Moisture vapor transmission: ASTM E96; 0.04 perm.
3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape

1. Manufacturers:
   a. Polyken Model 236.
   b. Or equal.

E. Tie Wire: Annealed steel, 16 gauge (1.5 mm).

2.02 GLASS FIBER DUCT LINER, FLEXIBLE

A. Manufacturers:

1. Certainteed Tough Guard R with ES.
2. Or equal.

B. Insulation: ASTM C553; flexible, noncombustible blanket.

1. 'K' ('Ksi') value: ASTM C518, 0.24 at 75 degrees F (0.035 at 24 degrees C).

2. Maximum service temperature: 250 degrees F (121 degrees C).

C. Adhesive

1. Waterproof fire-retardant type

2.. Manufacturers:

a. Kingco/Glenkote Seal-Flex Model 11-500.
b. Or equal.

D. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

2.03 INSULATION MATERIALS – REFRIGERANT PIPING

A. Flexible Elastomeric for refrigerant pipes: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials. Glue all joints with manufacturer sealant.

1. Products: Subject to compliance with requirements, include, but are not limited to, the following:
   a. Aeroflex USA Inc.; Aerocel.
   b. Armacell LLC; AP Armaflex.
   c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

2. Pipe insulation must be installed strictly in accordance with insulation manufactures installation instructions. Insulation thickness shall be per the 2022 building energy efficiency standards, requirements for pipe insulation and table 120.3-a

2.04 FIELD-APPLIED JACKETS

Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. Metal Jacket: Install at exterior locations.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Childers Products, Division of ITW; Metal Jacketing Systems.
   b. PABCO Metals Corporation; Surefit.
   c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacketing with formed aluminum fittings.

2.05 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products; Bands.
b. PABCO Metals Corporation; Bands.
c. RPR Products, Inc.; Bands.

2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, ½ inch.
3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1). AGM Industries, Inc.; CWP-1.
      2). GEMCO; CD.
      3). Midwest Fasteners, Inc.; CD.
      4). Nelson Stud Welding; TPA, TPC, and TPS.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.03 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Keep insulation materials dry during application and finishing.

F. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

G. Install insulation with least number of joints practical.

3.04 INSTALLATION

A. Install materials in accordance with Manufacturer's instructions.

B. Insulated ductwork conveying air below ambient temperature:

1. Provide insulation with vapor barrier jackets.

2. Finish with tape and vapor barrier jacket.

3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.

4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

C. Insulated ductwork conveying air above ambient temperature:

1. Provide with or without standard vapor barrier jacket.

2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

D. External Duct Insulation Application:

1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.

2. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.

3. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.

4. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

E. Exposed Spiral Duct and Plenum Liner Application:

1. Adhere insulation with adhesive for 100 percent coverage.

2. Secure insulation with mechanical liner fasteners. Refer to SMACNA Standards for spacing.

3. Seal and smooth joints.

4. Seal liner surface penetrations with adhesive.

5. Unless indicated otherwise on plans, duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for liner thickness.

3.05 TOLERANCE

A. Substituted insulation materials shall provide thermal resistance within 10 percent at normal conditions, as materials indicated.

3.06 FLEXIBLE GLASS FIBER DUCTWORK INSULATION SCHEDULE

DUCTWORK	THICKNESS Inch (mm)	FINISH
Outside Air Intake Ducts	2" (76.2)	Alum. Foil
Supply Ducts	2" (76.2)	Alum. Foil
Return Ducts	2" (76.2)	Alum. Foil
LINER	THICKNESS Inch (mm)	FINISH
Supply and Return Plenums	1” (76.2)	

END OF SECTION

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Section 23 2300
Refrigerant Piping

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping.

B. Refrigerant.

C. Moisture and liquid indicators.

D. Valves.

E. Strainers.

F. Check valves.

G. Pressure relief valves.

H. Filter-driers.

I. Solenoid valves.

J. Expansion valves.

1.02 RELATED SECTIONS

A. Section 23 0700 - HVAC Insulation.

1.03 REFERENCES

A. ARI 710 - Liquid Line Dryers.

B. ARI 730 - Flow-Capacity Rating and Application of Suction-Line Filters and Filter-Driers

C. ARI 750 - Thermostatic Refrigerant Expansion Valves.

D. ARI 760 - Solenoid Valves for Use With Volatile Refrigerants.

E. ASHRAE 15 - Safety Code for Mechanical Refrigeration.

F. ASHRAE 34 - Number Designation of Refrigerants.

G. ASME - Boiler and Pressure Vessel Codes, SEC 9 Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.

H. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

I. ASME B16.26 - Cast Copper Alloy Fittings For Flared Copper Tubes.

J. ASME B16.50 – Wrought Copper and Copper Alloy Braze-Joint Pressure Fitting

K. ASME B31.5 - Refrigeration Piping.

L. ASTM B280 - Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

M. AWS A5.8 - Brazing Filler Metal.

1.04 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. Valves

1. Use factory-supplied service valves on condensing units.

C. Replaceable Cartridge Filter-Driers:

D. Solenoid Valves:

1. Use in liquid line of single evaporator systems.

1.05 SUBMITTALS

A. Submit under provisions of the general requirements.

B. Shop Drawings: Provide shop drawings indicating manufacturer approved refrigerant piping, including equipment, critical dimensions, and sizes.

C. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.

D. Manufacturer's Installation Instructions: Indicate sizes, support, connection requirements, and isolation for servicing.

E. Submit welders certification of compliance.

1.06 PROJECT RECORD DOCUMENTS

A. Submit under provisions of the general requirements.

B. Record exact locations of equipment and refrigeration accessories on record drawings.

1.07 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of the general requirements.

B. Maintenance Data: Include instructions for changing cartridges, assembly views, spare parts lists.

1.08 REGULATORY REQUIREMENTS

A. Conform to ASME B31.9 for installation of piping system.

B. Welding Materials and Procedures: Conform to ASME SEC 9.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of the general requirements.

B. Deliver and store piping and specialties in shipping containers with labeling in place.

C. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

D. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

1.10 WARRANTY

A. Provide one year warranty under provisions of the general requirements.

PART 2 PRODUCTS

2.01 PIPING

A. Copper Tubing: ASTM B280, Type ACR annealed.

1. Fittings: ASME B16.22 wrought copper.

2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F (640 to 805 degrees C).

B. Pipe Supports and Anchors:

1. Conform to Section 23 0529

2.02 REFRIGERANT

A. Refrigerant: ASHRAE 34

1. R-410A.

2.03 REFRIGERANT PIPING

A. Insulate with closed cell neoprene insulation. Install 3/16” corrugated 0.016 aluminum jacketing with aluminum formed fittings at exterior.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

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 not interfere with use of space.

D. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Arrange piping to return oil to compressor.

G. Provide clearance for installation of insulation and access to valves and fittings.

H. Flood piping system with nitrogen when brazing.

I. Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.

J. Prepare unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to the general requirements.

K. Insulate piping and install aluminum jacket at exterior locations.

L. Follow ASHRAE 15 procedures for charging and purging of systems and for disposal of refrigerant.

M. Provide replaceable cartridge filter-driers.

N. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.

O. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.

P. Fully charge completed system with refrigerant after testing.

Q. Provide electrical connection to solenoid valves.

END OF SECTION

Section 23 3113
Metal Ducts

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.

1.03 PERFORMANCE REQUIREMENTS

A. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

1. Seismic Hazard Level A: Seismic force to weight ratio, 0.48.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2022.

1.04 SUBMITTALS

A. Product Data: For each type of the following products:

1. Ductwork materials
2. Sealants and gaskets.

B. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Structural members to which duct will be attached.

1.05 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2022, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2022, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.01 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Lindab Inc.
b. McGill AirFlow LLC.
c. SEMCO Incorporated.
d. Sheet Metal Connectors, Inc.
e. Spiral Manufacturing Co., Inc.
f. Omni Duct Systems.

2.02 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60 or G-90 at exterior.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.
3. Beaded coupling connections sealed with high-temperature silicone.

C. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

D. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

E. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

F. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

G. Self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.03 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide a product by one of the following:

1. Cooper B-Line, Inc.; a division of Cooper Industries.
2. Ductmate Industries, Inc.
3. Hilti Corp.
4. Mason Industries.
5. Unistrut Corporation; Tyco International, Ltd.

PART 3 - EXECUTION

3.01 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round and flat-oval ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

3.02 DUCT SEALING

M. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

N. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Conditioned Space, Exhaust Ducts: Seal Class B.

3.03 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

C. Hangers Exposed to View: Threaded rod and angle or channel supports.

D. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

E. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.04 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on ducts that are suspended with vibration isolators.

3.05 CONNECTIONS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.06 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer.

3.07 DUCT SCHEDULE

A. Elbow Configuration:

1. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."

    a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

        1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
        2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.

    b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
    c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam or Welded.

B. Branch Configuration:

1. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees."

    a. Velocity 1000 fpm or less 45-degree lateral.

3.08 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.

C. Duct system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION

SECTION 23 3300
AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Flange connectors.
4. Flexible connectors.
5. Duct accessory hardware.
6. Penthouse Louvers

B. Related Sections:

1. Division 23 Section "Metal Ducts".

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

1.04 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60 (Z180) and G90 (Z275).
2. Exposed-Surface Finish: Mill phosphatized.

C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and exposed ducts.

D. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

F. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.02 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Duro Dyne Inc.
3. Greenheck Fan Corporation.
4. Nailor Industries Inc.
5. Pottorff; a division of PCI Industries, Inc.
6. Ruskin Company.

B. Description: Gravity balanced.

C. Maximum Air Velocity: 2000 fpm (10 m/s).

D. Maximum System Pressure: 1-inch wg (0.25 kPa).

E. Frame: 0.052-inch- (1.3-mm-) thick, galvanized sheet steel.

F. Blades: Multiple single-piece blades, center-pivoted, maximum 6-inch (150-mm) width, 0.025-inch- (0.6-mm-) thick, roll-formed aluminum with sealed edges.

G. Blade Action: Parallel.

H. Blade Seals: Felt.

I. Blade Axles:

1. Material: Galvanized steel.
2. Diameter: 0.20 inch (5 mm).

J. Tie Bars and Brackets: Galvanized steel.

K. Return Spring: Adjustable tension.

L. Bearings: Steel ball or synthetic pivot bushings.

M. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Electric actuators.
4. Chain pulls.
5. Screen Mounting: Front mounted in sleeve.
    a. Sleeve Thickness: 20-gage (1.0-mm) minimum.
    b. Sleeve Length: 6 inches (152 mm) minimum.
6. Screen Mounting: Rear mounted.
7. Screen Material: Galvanized steel.
8. Screen Type: Insect.
9. 90-degree stops.

2.03 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Air Balance Inc.; a division of Mestek, Inc.
    b. McGill AirFlow LLC.
    c. METALAIRE, Inc.
    d. Nailor Industries Inc.
    e. Pottorff; a division of PCI Industries, Inc.
    f. Ruskin Company.
2. Standard leakage rating.
3. Suitable for horizontal or vertical applications.
4. Frames:
    a. Hat-shaped, galvanized-steel channels, 0.064-inch (1.62-mm) minimum thickness.
    b. Mitered and welded corners.
    c. Flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
    a. Single blade for ducts up to 24”. Multiple blades for ducts greater than 24”.
    b. Opposed blade design for multiple blade dampers.
    c. Stiffen damper blades for stability.
    d. Galvanized-steel, 0.064 inch (1.62 mm) thick.
6. Blade Axles: Galvanized steel.
7. Bearings:
    a. Oil-impregnated bronze.

b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Galvanized steel.

9. Where damper is not accessible install remote damper operator adjustment assembly.

2.04 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.

B. Description: Add-on, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel for galvanized steel ducts.

D. Material: Stainless steel for stainless steel ducts.

E. Gauge and Shape: Match connecting ductwork.

2.05 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. METALAIRE, Inc.
4. SEMCO Incorporated.
5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."

D. Vane Construction: Single wall.

E. Vane Construction: Single wall for ducts up to 48 inches (1200 mm) wide and double wall for larger dimensions.

2.06 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches (89 mm) wide attached to 2 strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd. (810 g/sq. m).
2. Tensile Strength: 530 lbf/inch (93 N/mm) in the warp and 440 lbf/inch (77 N/mm) in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F (Minus 45 to plus 121 deg C).

G. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch (6-mm) movement at start and stop.

2.07 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.08 PENTHOUSE LOUVER

A. Manufacturer

1.. Ruskin

2. Aluminum Louvers, aluminum roof, bird screen with 8” high sheet metal curb, custom baked enamel finish

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and stainless-steel accessories in stainless-steel ducts.

C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire and smoke dampers according to UL listing.

H. Connect ducts to duct silencers rigidly.

I. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.

2. Upstream from duct filters.
3. At outdoor-air intakes and mixed-air plenums.
4. At drain pans and seals.
5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
7. At each change in direction and at maximum 50-foot (15-m) spacing.
8. Upstream from turning vanes.
9. Upstream or downstream from duct silencers.
10. Control devices requiring inspection.
11. Elsewhere as indicated.

J. Install access doors with swing against duct static pressure.

K. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
4. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).
5. Body Access: 25 by 14 inches (635 by 355 mm).
6. Body plus Ladder Access: 25 by 17 inches (635 by 430 mm).

L. Label access doors according to Division 22 Section "Identification for Plumbing Piping and Equipment" to indicate the purpose of access door.

M. Install flexible connectors to connect ducts to equipment.

N. For fans developing static pressures of 5-inch wg (1250 Pa) and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

O. Install Penthouse louvers with duct connection and backdraft damper on reliefs where shown.

3.02 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Inspect turning vanes for proper and secure installation.
4. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION

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SECTION 23 3713
DIFFUSERS, REGISTERS, GRILLES, AND LOUVERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Ceiling Diffusers.

B. Related Sections:

1. Division 23 Section "Air Duct Accessories" for volume-control dampers not integral to diffusers, registers, and grilles.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples for Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.

C. Samples for Verification: For louvers to verify color selected.

D. Source quality-control reports.

PART 2 - PRODUCTS – SEE SCHEDULE ON PLANS

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.03 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

Section 23 8126
Variable Flow Heat Pump

PART 1 GENERAL

1.01 SYSTEM DESCRIPTION

A. The variable capacity, heat pump/heat recovery air conditioning system shall be a SAMSUNG Electronics DVM S (Variable Refrigerant Flow) System. The DVM S systems shall be HR (simultaneous cooling and heating) split system heat recovery or HP (cool/heat) split system heat pump with multiple indoor units.

1.02 PIPING

A. Piping to multiple indoor units requires additional piping components. The VRF equipment manufacturer's Y-joint fittings and/or Heat Recovery Mode Control Units (MCU) must be used to branch the main refrigerant lines.

B. The VRF equipment manufacturer's Tee fittings must be used to connect outdoor units when multiple module systems are being installed (systems with more than one outdoor unit).

1.03 QUALITY ASSURANCE

A. The units shall be listed by Electrical Laboratories (ETL) and bear the ETL label.

B. All wiring shall be in accordance with the National Electrical Code (N.E.C.).

C. The units shall be manufactured in a facility registered to ISO 9001 and ISO14001 which is a set o f standards applying to environmental protection set by the International Standard Organization (I SO).

D. A full charge of R-410A for the condensing unit only shall be provided in the condensing unit. Ad ditional refrigerant is required based on diameters and lengths of system liquid refrigerant lines an d indoor equipment model and quantity.

E. The installing contractor must have attended Samsung DVM S installation training prior to installi ng the system.

F. Service and installation manuals must be readily available on the manufacturer's website without e ntering a username and password.

PART 2 OUTDOOR UNITS

2.01 DVM S ECO HEAT RECOVERY CONDENSING UNIT (208/230V, 1Ø)

A. The heat recovery system shall consist of an AM0**NXMDCR/AA outdoor unit, multiple indoor units (AM****N****/AA), and SAMSUNG DVM S NASA Control Network Solution (Control systems). The AM0**NXMDCR/AA outdoor unit shall be a horizontal discharge, 208/230 volt, single phase unit. The AM0**NXMDCR/AA outdoor system model numbers and the associated number of connectable indoor units per AM0**NXMDCR/AA outdoor unit is indicated in the following table. Each indoor unit or group of indoor units shall be independently controlled.

A. General:

1. The heat recovery outdoor unit shall be specifically used with SAMSUNG DVM S Heat recovery components. The SAMSUNG DVM S ECO HR system shall consist of AM0**NXMDCR/AA outdoor unit, HR Changer (MCU-R4NEK0N), additional MCU's (mode control units) if required, indoor units (AM****N**CH/AA), and SAMSUNG DVM S NASA Control Network Solution (Control systems). AM0**NXMDCR/AA outdoor units shall be equipped with multiple circuit boards that interface to the SAMSUNG DVM S NASA Control Network Solution (Control systems) and shall perform all functions necessary for operation. The outdoor unit shall have a powder coated finish. The outdoor unit shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory.

2. The sum of connected capacity of all indoor air handlers shall range from 50% to 130% of outdoor rated capacity.

3. The heat recovery system compressors shall be SAMSUNG, hermetically sealed, inverter driven, Twin BLDC Rotary type (AM0**NXMDCR/AA models) or flash injected, asymmetric scroll (AM060NXMDCR/AA only). No fixed capacity compressors shall be present in the refrigerant system.

4. All refrigerant lines from the outdoor unit shall be insulated.

5. The heat recovery outdoor unit shall have an accumulator

6. The heat recovery outdoor unit shall have a high-pressure safety switch, over-current protection, thermal fan protection, low pressure protection, compressor overcurrent protection, fan motor voltage protection, current transformer(s), crank case heating, and intelligent logic to ensure proper operation within unit design limitations and operational parameters.

7. The heat recovery outdoor unit shall have the ability to operate with a maximum height difference of 164 feet with the condensing unit installed higher than the indoor units or 131 feet with the condensers installed lower than the indoor units. The greatest length is not to exceed 492 (574 equivalent) feet between outdoor unit and the farthest indoor unit.

8. The heat recovery outdoor unit shall be capable of operating in cooling mode between 0°F ~ 118°F (-18°C ~ 48°C) outdoor ambient temperatures. When outdoor temperature is between 0°F ~ 23°F (-18°C ~ -5°C), wind baffles are required. When outdoor temperature is between 0°F ~ 23°F (-18°C ~ -5°C), 50% operating capacity should be maintained to ensure reliability while in cooling mode.

9. The heat recovery outdoor unit shall be capable of operating in heating mode between -13°F ~ 75°F (-25°C ~ 24°C) ambient temperatures.

10. The heat recovery system shall have installer enabled snow blowing settings to prevent snow accumulation in front of idle outdoor units during when below 42º F.

11. The heat recovery shall have the ability to adjust cooling and heating temperature/pressure compensation values depending on project conditions thus saving energy.

12. The heat recovery outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.

13. The heat recovery outdoor unit shall have a flat plate type sub-cooler to sub cool liquid refrigerant further to increase capacity and performance with long pipe lengths and to decrease refrigerant sounds at indoor equipment.

14. The heat recovery system shall have optional night quite modes to reduce unit sound in evenings (automatic activation or manual activation using MIM-B14 external contact interface module).

15. The heat recovery system shall have current control to limit current adjustable at outdoor unit. Maximum current limitation shall allow setting of 50 ~ 100% current limitation from design current in 5% increments.

16. The heat recovery outdoor unit shall have a removable EEPROM at the main PCB to store all unit data. All data on the outdoor unit EEPROM shall be viewable from the manufacturer provided service software. The outdoor unit main EEPROM shall be removable allowing replacement of outdoor unit PCB without losing digital, field programmed data. The outdoor unit removable EEPROM shall store the following unit data: unit model number, unit serial number, unit main PCB firmware and MICOM version, sub-PCB firmware and MICOM version, fan PCB firmware and MICOM version, inverter PCB 1 and inverter PCB 2 firmware and MICOM version, auto-trial commissioning startup data, the last 30 minutes of operation data, and field programmed unit name/tag viewable on controls and service software.

17. The heat recovery outdoor unit shall have outdoor unit pump-down operation capability allowing storage of refrigerant while opening sealed refrigerant pipe system outside of outdoor

unit chassis while performing service. The outdoor unit refrigerant storage shall be greater than the supplied factory R-410A charge.

18. The heat recovery outdoor unit shall have individual outdoor module pump-out operation capability allowing the majority of refrigerant in an outdoor unit to be pumped out. The pump-out feature shall allow service of sealed refrigerant system within an outdoor unit chassis.

19. In the event of system error due to outdoor unit failure, the heat recovery outdoor unit shall display codes that specify a precise cause of error.

20. The heat recovery outdoor unit shall have adjustable defrost operation characteristics adjustable at the outdoor PCB.

21. The heat recovery outdoor unit shall support the installation of an optional Samsung base pan heater kit (MCH-015EE). The optional base pan heater function shall be field enabled after installation of the kit.

B. Unit Cabinet:

1. The chassis shall be fabricated of galvanized steel, bonderized and finished with a powder coated baked enamel.

C. Fan:

1. The heat recovery outdoor unit shall be furnished with 2 axial fans with BLDC motors.

2. All fan motors shall have inherent protection, thermal protection, and have permanently lubricated bearings, and be completely variable speed.

3. All fan motors shall be mounted for quiet operation.

4. All fans shall be provided with a raised guard to prevent contact with moving parts.

5. The outdoor unit shall have horizontal discharge airflow.

A. Refrigerant:

1. R410A refrigerant shall be required for the heat recovery system.

2. Additional refrigerant is required. Amount is based on installed refrigerant pipe diameters and lengths and connected indoor unit models.

D. Coil:

1. The outdoor coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing.

2. The coil shall be protected with an integral metal guard.

3. The Heat Recovery condensing unit salt spray test method: ASTM B117 - the heat exchanger showed no unusual rust or corrosion development to 2,280 hours.

E. Compressor:

1. Refrigerant flow from the AM036NXMDCR/AA, AM048NXMDCR/AA, and AM053NXMDCR/AA heat recovery units shall be controlled by means of a capacity modulation capable Twin BLDC Rotary compressor.

2. Refrigerant flow from the AM060NXMDCR/AA heat recovery unit shall be controlled by means of a capacity modulation capable scroll compressor with flash injection. Flash injection technology is used to increase performance in both heating and cooling modes. This will be automatically enabled by the outdoor unit by forcing saturated refrigerant flash directly into the scroll compression cycle increasing mass flow and overall system capacity.

3. The heat recovery outdoor unit compressors shall have a soft-start function to reduce electricity demand during system start and to increase compressor reliability.

4. The compressors shall have crankcase heating capability.

5. The outdoor unit compressor shall have compressor controls that will allow modulation of capacity.

6. The compressor will be equipped with an internal thermal overload.

7. The compressor shall be mounted to avoid the transmission of vibration.

F. Electrical:

1. The outdoor unit electrical power shall be 208/230 volts, 1 phase, 60 hertz.

2. The 208/230 VAC unit shall be capable of satisfactory operation within voltage limitations of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).

3. The outdoor unit shall be controlled by integral microprocessors.

4. The control circuit between the indoor units and the outdoor unit shall be 0.5VDC - 7VDC completed using stranded, annealed copper conductor, 16 AWG, shielded, two-core cable to provide total integration of the system.

2.02 HR CHANGER (MODE CONTROL UNIT) FOR DVM S ECO 1Ø HEAT RECOVERY SYSTEMS (MCU-R4NEK0N)

A. General:

The HR CHANGER MCU (Mode Control Unit) shall be specifically used with R410A, AM0**NXMDCR/AA heat recovery outdoor units. These units shall be equipped with a circuit board that interfaces to the SAMSUNG DVM S NASA Control Network Solution (Control systems) and shall perform all functions necessary for operation. The unit shall have a galvanized steel finish. The HR Changer MCU (Mode Control Unit) shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory. The unit shall be mounted indoors.

Indoor unit connection data is noted below.

MCU Model Number	***Connectable Indoor Unit Qty.***	***Port Qty.***	***Sum of Indoor Unit Capacity (maximum)***
MCU-R4NEK0N	1 - 12	4	Up to 76,000 Btu/h

1. MCU-R4NEK0N (HR Changer) shall have 4 ports with a maximum connected quantity of 12 indoor units (maximum 3 indoor units per port). The sum of indoor unit's capacity shall not exceed 19 MBH (19,000 btu/h) per port, and 76 MBH (76,000 btu/h) total. Two (2) adjacent ports shall be twinned using Y-Joint part number MXJ-YM1206R (purchased separately) when connecting indoor unit(s) greater than 19 MBH (19,000 btu/h), but less than 48 MBH (48,000 btu/h). The MCU-R4NEK0N shall not connect under-ceiling indoor units without the installation of single zone EEV kits (MEV-A**SA). MCU-R4NEK0N shall allow series connection of additional MCU's reducing Y-joint installation to a maximum capacity of (76 MBH) 76,000 btu/h. The MCU-R4NEK0N is only compatible with AM***NXMDCR/AA (DVM S ECO), and must be installed on every system.

B. HR CHANGER MCU (Mode Control Unit) Cabinet:

1. The chassis shall be fabricated of galvanized steel.

2. Each cabinet shall house multiple refrigeration control solenoid valves and electronic expansion valves.

3. MCU-R4NEK0N shall house four tube-in-tube subcooling devices with electronic expansion valve and temperature sensors to maintain design refrigerant temperatures (sub cooling). All pipe connections shall be braze type

C. Refrigerant:

1. R410A refrigerant shall be required for MCU's (Mode Control Units).

D. Refrigerant valves:

1. The unit shall be furnished with multiple two position solenoid valves.

2. When connecting an indoor unit greater than 19,000 btu/h and less than or equal to 48,000 btu/h to MCU-R4NEK0N (HR Changer) or MCU-S4NEK3N, two adjacent branch circuits shall be joined together at the branch controller to deliver an appropriate amount of refrigerant. The two refrigerant valves shall operate simultaneously. The Y-joints necessary to connect 2 circuits or ports are sold separately.

3. Electronic expansion valves and solenoid valves shall be used to control the variable refrigerant flow inside each HR Changer MCU (Mode Control Units).

E. Integral Drain Pan:

1. MCU-6NEK3N shall include an integral condensate pan. Drain connection is not required

F. Electrical:

1. The unit electrical power shall be 208/230 volts, 1 phase, and 60 hertz.

2. The unit shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253V (230V/60Hz).

3. The MCU (Mode Control Unit) shall be controlled by integral microprocessors.

4. The control circuit between the indoor units, MCU (Mode Control Unit) and the heat pump/heat recovery outdoor unit shall be 0.5VDC - 7VDC completed using stranded, annealed copper conductor, two conductor, 16 AWG, shielded cable to provide total integration of the system.

2.03 MCU (MODE CONTROL UNIT) FOR HEAT RECOVERY SYSTEMS

A. General:

The MCU (Mode Control Unit) shall be specifically used with R410A, AM****X***R/AA and AM****X***R2AA heat recovery outdoor units. These units shall be equipped with a circuit board that interfaces to the SAMSUNG DVM S NASA Control Network Solution (Control systems) and shall perform all functions necessary for operation. The unit shall have a galvanized steel finish. The MCU (Mode Control Unit) shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory. The unit shall be mounted indoors. The sum of connected capacity of indoor units shall range from 7,000 – 216,000 btu/h capacity at one MCU

depending on model. The AM****X***R/AA and AM****X***R2AA heat recovery outdoor units shall connect multiple MCUs, up to 16 total per system.

There shall be nine models of Mode Control Units: MCU-S4NEE1N, MCU-S6NEE1N, MCU-S4NEE2N, MCU-S2NEK1N, MCU-S1NEK1N, MCU-S2NEK2N, MCU-S4NEK3N, MCU-S6NEK2N, and MCU-S6NEK3N. The below table identifies MCU models and indoor unit connection data.

MCU Model Number	***Connectable Indoor Unit Qty.***	***Port Qty.***	***Sum of Indoor Unit Capacity (maximum)***
MCU-S1NEK1N	1 - 8	1	Up to 54,000 Btu/h
MCU-S2NEK2N	1 - 16	2	Up to 108,000 Btu/h
MCU-S4NEK3N	1 - 32	4	Up to 216,000 Btu/h
MCU-S6NEK2N	1 - 32	6	Up to 216,000 Btu/h
MCU-S6NEK3N	1 - 18	6	Up to 76,000 Btu/h

1. MCU-S1NEK1N shall have 1 port with a maximum connected quantity of 8 indoor units. The sum of indoor unit's capacity shall not exceed 54 MBH (54,000 btu/h). The MCU-S1NEK1N shall not connect under-ceiling indoor units without the installation of single zone EEV kits (MEV-A**SA).

2. MCU-S2NEK2N shall have 2 ports with a maximum connected quantity of 16 indoor units (m aximum 8 indoor units per port). The sum of indoor unit's capacity shall not exceed 54MBH (54,000 btu/h) per port, and 108 MBH (108,000 btu/h) total. Two (2) adjacent ports shall be t winned using Y-Joint part number MXJ-YA1509M (purchased separately) when connecting in door unit(s) greater than 54 MBH (54,000 btu/h), but less than 108 MBH (108,000 btu/h). Th e MCU-S2NEK2N shall not connect under-ceiling indoor units without the installation of sing le zone EEV kits (MEV-A**SA). Ports shall be twinned using Y-Joint part number MXJ-YA1 509M (purchased separately) when connecting indoor units greater than 54 MBH (54,000 btu/ h), but less than 108 MBH (108,000 btu/h). MCU-S2NEK2N shall allow series connection of additional MCU's reducing Y-joint installation to a maximum capacity of (108 MBH) 108,00 0 btu/h.

3. MCU-S4NEK3N shall have 4 ports with a maximum connected quantity of 32 indoor units (m aximum 8 indoor units per port). The sum of indoor unit's capacity shall not exceed 54MBH (54,000 btu/h) per port, and 216 MBH (216,000 btu/h) total. Two (2) adjacent ports shall be t winned using Y-Joint part number MXJ-YA1509M (purchased separately) when connecting in door unit(s) greater than 54 MBH (54,000 btu/h), but less than 108 MBH (108,000 btu/h). Th e MCU-S4NEK3N shall not connect under-ceiling indoor units without the installation of sing le zone EEV kits (MEV-A**SA). MCU-S4NEK3N shall allow series connection of additiona l MCU's reducing Y-joint installation to a maximum capacity of (216 MBH) 216,000 btu/h.

4. MCU-S6NEK2N shall have 6 ports with a maximum connected quantity of 32 indoor units (m aximum 8 indoor units per port). The sum of indoor unit's capacity shall not exceed 54MBH (54,000 btu/h) per port, and 216 MBH (216,000 btu/h) total. Two (2) adjacent ports shall be t winned using Y-Joint part number MXJ-YA1509M (purchased separately) when connecting in door unit(s) greater than 54 MBH (54,000 btu/h), but less than 108 MBH (108,000 btu/h). Th e MCU-S6NEK2N shall not connect under-ceiling indoor units without the installation of sing le zone EEV kits (MEV-A**SA). MCU-S6NEK2N shall allow series connection of additiona l MCU's reducing Y-joint installation to a maximum capacity of (216 MBH) 216,000 btu/h.

5. MCU-S6NEK3N shall have 6 ports with a maximum connected quantity of 18 indoor units (m aximum 3 indoor units per port). The sum of indoor unit's capacity shall not exceed 19 MBH (19,000 btu/h) per port, and 76 MBH (76,000 btu/h) total. Two (2) adjacent ports shall be twi nned using Y-Joint part number MXJ-YM1206M (purchased separately) when connecting ind oor unit(s) greater than 19 MBH (19,000 btu/h), but less than 48 MBH (48,000 btu/h). The M CU-S6NEK3N shall not connect under-ceiling indoor units without the installation of single z one EEV kits (MEV-A**SA). MCU-S6NEK3N shall allow series connection of additional M CU's reducing Y-joint installation to a maximum capacity of (76 MBH) 76,000 btu/h.

B. MCU (Mode Control Unit) Cabinet:

1. The chassis shall be fabricated of galvanized steel.

2. Each cabinet shall house multiple refrigeration control solenoid valves and electronic expansion valves.

3. MCU-S1NEK1N shall house one tube-in-tube subcooling device with electronic expansion valve and temperature sensors to maintain design refrigerant temperatures (sub cooling). All pipe connections shall be braze type.

4. MCU-S2NEK2N shall house two tube-in-tube subcooling devices with electronic expansion valve and temperature sensors to maintain design refrigerant temperatures (sub cooling). All pipe connections shall be braze type.

5. MCU-S4NEK3N shall house four tube-in-tube subcooling devices with electronic expansion valve and temperature sensors to maintain design refrigerant temperatures (sub cooling). All pipe connections shall be braze type.

6. MCU-R4NEK0N shall house four tube-in-tube subcooling devices with electronic expansion valve and temperature sensors to maintain design refrigerant temperatures (sub cooling). All pipe connections shall be braze type

7. MCU-S6NEK3N shall house six tube-in-tube subcooling devices with electronic expansion valve and temperature sensors to maintain design refrigerant temperatures (sub cooling). All pipe connections shall be braze type.

C. Refrigerant:

1. R410A refrigerant shall be required for MCU's (Mode Control Units).

D. Refrigerant valves:

1. The unit shall be furnished with multiple two position solenoid valves.

2. When connecting an indoor unit greater than 54,000 btu/h to MCU-S2NEK2N, MCU-S4NEK3N, and MCU-S6NEK2N, two adjacent branch circuits shall be joined together at the branch controller to deliver an appropriate amount of refrigerant. The two refrigerant valves shall operate simultaneously. The Y-joints necessary to connect 2 circuits or ports are sold separately.

3. When connecting an indoor unit greater than 19,000 btu/h but less than or equal to 48,000 btu/h to MCU-6NEK3N, two adjacent branch circuits shall be joined together at the branch controller to deliver an appropriate amount of refrigerant. The two refrigerant valves shall operate simultaneously. The Y-joints necessary to connect 2 circuits or ports are sold separately.

4. When connecting an indoor unit greater than 19,000 btu/h and less than or equal to 48,000 btu/h to MCU-R4NEK0N (HR Changer) or MCU-S4NEK3N, two adjacent branch circuits shall be joined together at the branch controller to deliver an appropriate amount of refrigerant. The two refrigerant valves shall operate simultaneously. The Y-joints necessary to connect 2 circuits or ports are sold separately.

5. Electronic expansion valves and solenoid valves shall be used to control the variable refrigerant flow inside each MCU (Mode Control Units).

E. Integral Drain Pan:

1. MCU-S1NEK1N, MCU-S2NEK2N, MCU-S4NEK3N, MCU-S6NEK2N, MCU-S6NEK3N, and MCU-6NEK3N shall include an integral condensate pan. Drain connection is not required

F. Electrical:

1. The unit electrical power shall be 208/230 volts, 1 phase, and 60 hertz.

2. The unit shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253V (230V/60Hz).

3. The MCU (Mode Control Unit) shall be controlled by integral microprocessors.

4. The control circuit between the indoor units, MCU (Mode Control Unit) and the heat pump/heat recovery outdoor unit shall be 0.5VDC - 7VDC completed using stranded, annealed copper conductor, two conductor, 16 AWG, shielded cable to provide total integration of the system.

PART 3 OUTDOOR UNIT ACCESSORIES

PART 4 INDOOR UNITS AND ACCESSORIES

4.01 MERV 13 ACCESSORY FILTER FOR 4-WAY CEILING CASETTE UNITS (MF-C6A0)

1. The MERV 13 filter shall attach to cassette fascia panel without additional adapters
2. Minimal CFM loss after field programming
3. Test method: ANSI/ASHRAE 52.2
4. The optional filter shall be compatible with the DVM S 4-way Cassettes.
5. Compatible with cassette facia panel model numbers: PC4NUFMAN, PC4NUFMUN and PC4NUSKFN.

4.02 WINDFREE™ MINI 4-WAY CEILING CASSETTE WITH GRILLE INDOOR UNIT (AM0NNNDCH/AA)**

A. General:

The indoor unit shall be a WindFree™ mini 4-way cassette style indoor unit that recesses into the ceiling with a ceiling grille (ordered separately, WindFree™ facia panel part number: PC4SUFMUN) and shall have a modulating expansion device. The mini 4-way cassette shall be compatible with DVM S HR (Heat Recovery) outdoor units and MCU (Mode Control Unit) or DVM S HP (Heat Pump) outdoor units. The WindFree™ mini 4-way cassette shall have an optional motion detection sensor (MCR-SMD) to enable/disable the unit based on motion with optional time delay settings. (Refer to Part 4 of this specification for more MCR-SMD details). The WindFree™ mini 4-way cassette shall support individual control using SAMSUNG DVM S NASA Control Network Solution (Control systems).

1. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit sh all be all factory wiring, piping, electronic modulating expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanis m, an auto restart function. Indoor unit and refrigerant pipes shall be charged with dehydrated air (Nitrogen gas) before shipment from the factory.
2. The indoor unit shall include a WindFree™ function that will close the supply air outlet louver s while in cooling mode to gently disperse cool air into the space through thousands of micro-holes on the fascia panel without blowing directly onto occupants. WindFree™ operation prev ents direct airflow onto occupants thus increasing occupant comfort.
3. The WindFree™ feature is optional and can be enabled using local and central control options

provided by the VRF manufacturer

4. The indoor unit WindFree™ fascia panel shall include a humidity sensor to prevent condensati on formation by restricting WindFree™ operation in high humidity conditions.

** The WindFree™ unit delivers an air current that is under 0.15 m/s while in WindFree™ mode. Air velocity that is below 0.15 m/s is considered "still air" as defined by ASHRAE (American Society of Heating, Refrigerating, and Air-Conditioning Engineers).*

B. Unit Cabinet:

1. The cabinet shall be space-saving ceiling-recessed cassette.

2. Service of electronics, high and low voltage connection, condensate pump, fan, fan motor, sen sors, EEV, condensate pan, and other components shall be accessible from the bottom of the c assette unit not requiring access from the sides of the unit.

3. Construction shall be insulated HIPS chassis with a galvanized steel frame and fascia panel cer tified to UL94 V0.

4. The cabinet panel shall have provisions for a field installed, filtered, outside air intake. A boos ter fan is necessary. A 12V DC relay terminal is available to control the booster fan (with sep arate PCB connector).

5. The compact cabinet size can be installed in one standard ceiling tile (24" x 24").

6. The indoor unit fascia panel shall have LED indicator lights on the front and an IR receiver for wireless controller use.

7. PC4SUFMUN cassette fascia panel is 24 3/8" X 24 3/8" to not overlap past a standard 24" X 24" ceiling grid.

C. Fan:

1. The indoor fan assembly shall be a turbo fan direct driven by a single motor.

2. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.

1. The indoor fan shall consist of three (3) speeds, Low, Mid, and High. Auto fan speed setting is available.

3. The auto air swing vanes (4) shall be capable of automatically swinging up and down for uniform air distribution.

4. The supply air vanes shall have independent control capability (32° – 65° control range) adjustable with optional wireless or wired controllers.

5. The cabinet shall have a fresh air intake opening to accommodate the introduction of fresh air into the space.

D. Filter:

1. Return air shall be filtered by means of a long-life washable permanent filter included with fascia panel.

E. Coil:

1. The indoor coil shall be of nonferrous construction with slit fins on copper tubing.

2. The tubing shall have inner grooves for high efficiency heat exchange.

3. All tube joints shall be brazed with phos-copper or silver alloy.

4. The coils shall be pressure tested at the factory.

5. A condensate pan and drain outlet shall be provided under the coil.

6. The coil fins are coated with hydrophilic paints.

7. The condensate lift mechanism shall be able to raise drain water 29 inches above the condensate pan with float switch.

8. Both refrigerant lines to the mini four-way cassette indoor units shall be insulated.

F. Electrical:

1. The unit electrical power shall be 208/230 volts, 1-phase, and 60 hertz.

2. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).

3. The control circuit between the indoor units, MCU (Mode Control Unit) and the heat pump/heat recovery outdoor unit shall be 0.5VDC - 7VDC completed using stranded, annealed copper conductor, two-core, 16 AWG, shielded cable to provide total integration of the system

4. The indoor unit shall have a thermal fuse under high-voltage terminal block to disable unit in the event of overheating due to electrical malfunction/poor connection.

G. Controls:

1. This unit shall use controls provided by the VRF manufacturer to perform functions necessary to operate the system. Please refer to the "Controls" section of this guide specification for details on controllers and other control options.

2. The indoor unit shall have a removable EEPROM on its PCB to store all unit data. All data on the indoor unit EEPROM shall be viewable from the manufacturer provided service software. The indoor unit main EEPROM shall be removable allowing replacement of indoor unit PCB without losing digital, field programmed data. The indoor unit removable EEPROM shall store the following unit data: unit model number, unit serial number, unit PCB firmware and MICOM version, and field programmed unit name/tag viewable on controls and service software.

3. The indoor unit shall have advanced external heater control programming capability for supplemental heat. External heat control shall be done with MIM-B14 external contact control module (refer to the "Controls" section of this guide specification). External heat control signal shall enable and disable a supplemental heat source based on selectable room temperature and set temperature differences. External heat control signal shall include a selectable time delay before the supplemental external heat source is activated.

4. The indoor unit shall have advanced unoccupied room control capability. Unoccupied room control can be used to reduce system demand when a room is not occupied by changing zone settings. Unoccupied room control shall be done with MIM-B14 external contact control module (refer to the "Controls" section of this guide specification). The unoccupied settings can be modified central control gateways provided by the VRF manufacturer or programmed with the manufacturer provided service software. Unoccupied room control shall provide four setting options to modify indoor unit operation when in "unoccupied mode". Settings shall include indoor unit ON/OFF, fan speed, and set temperature adjustment.

5. The indoor unit shall feature a Dual Set point function that allows users to set separate heating and cooling set temperatures using MWR-WG00UN wired controller and central control options MIM-D01AUN, MIM-B17BUN, and MIM-B18BUN. Dual set temperature allows the user to specify a deadband where the unit will not heat or cool when room temperature is between the heating and cooling set temperatures. Dual set temperature can be used with heat pump or heat recovery systems.

6. The indoor unit shall feature an Emergency Temperature Output (ETO) function that will provide a signal when an indoor unit is in error status. When enabling ETO, a high room temperature threshold can also be programmed to provide a signal when the room temperature limit has been exceeded. The ETO signal can be used to activate backup systems, provide a simple signal to a building management system, or to provide a simple visual/audible notification locally (ex: LED, buzzer, etc.). An MIM-B14 External Contact Control interface module is required for each unit that will provide or receive an ETO signal.

PART 5 CONTROLS

5.01 CONTROLS OVERVIEW

A. General:

The DVM S Controls Network Solution shall be capable of supporting remote controllers, schedule timers, system controllers, centralized controllers, an integrated web based interface, graphical user workstation, and system integration to Building Management Systems via BACnet® and LonWorks®.

B. Electrical Characteristics:

1. General:

(a) Local DVM S Controls Solution devices shall operate at 12V DC. Controller power and c ommunications shall be via a common communications bus.

(b) Central DVM S Controls Solution devices shall communicate via a common central layer communications bus.

C. Wiring:

1. Main system control wiring (COM1, F1/F2) shall be installed in a system daisy chain configur ation from the indoor equipment to MAIN outdoor unit. This cable shall be 16 AWG X 2, shi elded cable.

2. Zone control wiring (COM2, F3/F4) to wired remote controllers (MWR-*****N) shall be run from the indoor unit terminal block to the controller associated with that unit. This cable shall be 16 AWG X 2, shielded cable.

3. Control wiring for system controllers and centralized controllers (upper level) shall be installe d in a daisy chain configuration from main condensing unit to main condensing unit (R1/R2), to system controllers.

4. Communication wire connection (OF1/OF2) between main outdoor unit modules (systems wit h 2 or more modules) must be connected from the MAIN unit to SUB1 and SUB2 (where app licable). This wire shall be 2-conductor, 16 AWG X 2, shielded cable.

5. MST-P3P (S-NET 3 software) shall be capable of being networked with up to 16: MIM-D00A N (DMS2), MIM-D01AUN (DMS2.5), MIM-B17N (BACnet gateway 2.0), MIM-B17BUN (BACnet gateway 2.5), MIM-B18 (LonWorks gateway2.0), and/or MIM-B18BUN (Lon Work s gateway 2.5) system controllers for web/LAN based control for consolidated control.

D. Wiring type:

1. COM1 and COM2 control wiring shall be 2-conductor, 16 AWG X 2, shielded cable.

2. Network wiring shall be CAT-5e with RJ-45 connection.

5.02 DVM CONTROL NETWORK SOLUTION

A. General:

The SAMSUNG DVM S NASA Control Network Solution consists of remote controllers, system controllers, centralized controllers, and/or integrated web based interface communicating over a high-speed communication bus. The SAMSUNG DVM S NASA Control Network Solution shall support operation monitoring, scheduling, error monitor, power distribution, personal browsers, tenant billing, online maintenance support, and integration with Building Management Systems (BMS) using either LonWorks® or BACnet® interfaces.

5.03 MULTI-FUNCTION CONTROLLER – ADVANCED WIRED CONTROLLER (MWR-WG00UN)

A. Compatibility:

1. DVM S systems (AM**********AA, MCM-D211UN), DVM Chiller FCU kits (MCM-F00 N), 2020 RAC single zone high-wall units (AR**TSF*BWKNCV, RNS***BT), CAC indo or units (AC0***N****/AA) and FJM indoor units (AJ0**TN*DCH/AA, JNH***DT).

B. Connection:

1. The wired controller shall control up to 16 SAMSUNG indoor units (defined and controlled as one group).

C. Dimensions:

1. The wired controller shall be approximately 4 3/4” x 4 3/4” in size and white in color

D. The wired controller shall control SAMSUNG indoor units as follows:

1. Air handler operation ON/OFF

2. Air handler operation mode, set temperature, air flow direction, fan speed, individual louve r control (with supported indoor units).

3. Discharge air temperature (with supported indoor units)

4. Dual Set Temperature (with supported indoor units)

5. Setback function
6. Quiet and sleep modes
7. Error display (up to 10 error codes with descriptions)
8. Filter replacement alarm display and reset
9. Single indoor unit control or multiple unit control (maximum 16 units)
10. Energy saving operation:
    (a) Upper/lower temperature setting
    (b) Automatic operation stop function
    (c) Energy saving operation mode
    (d) Energy consumption monitoring
11. Weekly operating schedule setting:
    (a) Weekly and yearly operating schedule
    (b) Options to set: desired A/C operation mode, setting temperature, power mode (ON /OFF), and fan speed to operate based on weekly or daily schedules
    (c) Optional schedule exception day setting
12. Advanced HP auto changeover control and configuration
13. Supports multiple languages
14. Error code display with description (ten most recent error codes)

E. Other wired controller features:

1. Different button permission levels
2. Partial button lock option (on/off, temperature setting, fan speed, all modes, auto mode, coo l mode, heat mode, dry mode, fan mode, and schedule setting buttons can be locked indivi dually)
3. Backlight with option to dim the display after a specified time
4. Daylight savings clock advance option

5. Upper and lower temperature setting restriction
6. Heat mode skip (cooling only)
7. Restrict wireless controller signal (optional)
8. Real-time clock function - current time/day display function
9. Built in IR receiver for indoor unit control using a wireless controller and integral room tem perature sensor.
10. Indoor unit operation state display
11. Indoor unit service mode support
12. Micro SD card slot for simple firmware updating
13. Individual louver/blade control for 4-way and mini 4-way cassettes.
14. Individual air direction control for 360 Cassette indoor units.
15. Quiet Mode setting (for supported units)
16. Service mode for connected indoor unit operation monitoring, addressing, and setup
17. Built-in room temperature sensor
18. Indoor unit operation state display
19. Service mode support (Indoor unit addressing, indoor unit cycle data monitoring, option c ode monitoring and setting, and option setting/monitoring).
20. Time synchronization with central control gateways provided by the VRF manufacturer.
21. WindFree™ display and control for supported indoor unit models.
22. Motion Detection Sensor Control (On/Off, Indirect/Direct) for supported indoor unit mod els. Indirect/Direct control only applies to supported units that have MCR-SMC and MCR-SMD installed.
23. Clean and Long reach function for supported indoor unit models.
24. Automatic air volume enable and status viewing (for Duct S models AM0**MNMDCH/A A, AM0**MNHDCH/AA, and AM0**RNMDCH/AA).

25. Maximum current control for DVM S 3Ø outdoor systems

F. Specifications:

1. Two (2) conductor connection, PLC, (F3/F4).
2. DC 12V (power supplied by indoor unit via F3/F4 connection).
3. RS485 communication (F3/F4).
4. Can sense temperature via internal sensor, temperature sensor inside the air handler, or use t he average temperature between controller and air handler temperature sensors.
5. The wired controller shall have two screw terminals for wiring connections. Wire is not inc luded with controller.
6. 16AWG X 2 shielded cable is necessary for proper operation.
7. The wired controller shall allow up to 328 feet of wire from the farthest connected indoor u nit to the controller.

Multi-Function Controller			
Item	***Description***	***Operation***	***Display***
ON/OFF	Run and stop operation for a single group	Each Group	Each Group
Operation Mode	Switches between Auto/Cool/Dry/ Fan/Heat	Each Group	Each Group
Temperature Setting	1. Sets temperature for a single group. 2. Range of temperature setting (may vary depen ding on connected indoor unit) a. Auto/Cool/Dry: 65°F-86°F b. Heat: 47°F-86°F 3. Setting discharge outlet air temperature for su pported indoor units.	Each Group	Each Group
Discharge Air Temperature Setting	Sets temperature for supported ducted units	Each Group	Each Group

Multi-Function Controller			
Item	***Description***	***Operation***	***Display***
Fan Speed Setting	1. Models with 3 air flow speed settings: High / Mid/Low/Auto 2. WindFree™ mode enable/disable 3. Motion Detection Sensor Control 4. Clean and Long reach function for supported i ndoor unit models.	Each Group	Each Group
Air Flow Direction Setting	1. Air flow 2-step direction (Swing/Stop) 2. Direct setting at a specific angle. 3. Air flow operation varies depending on the m odel.	Each Group	Each Group
Scheduling	1. Weekly and yearly schedule settings (maximu m 8 yearly schedule groups) 2. Power ON/OFF, mode, temperature, and fan s peed settings can be set. 3. Configurable “Temporary Hold”/override dur ation for changes made when a schedule has b een programmed. 4. Maximum 49 total weekly and yearly schedul e settings can be set. 5. Real-time clock function: current time, day di splay function	Each Group	Each Group
Setback	1. Four (4) configuration patterns can be set (Wa ke, Leave, Return, Sleep). 2. Specify time, heating and cooling set temperat ures and mode.	Each Group	Each Group
Button lock	1. Button permission level setting (On/Off / Tem perature setting / Mode button / Fan speed) 2. Temperature limit setting 3. After power reset, the setting value is restored 4. Various restriction capabilities	Each Group	Each Group
Specified Function	Automatic stop setting (setting time range: 0-12 hours)	Each Group	Each Group

Multi-Function Controller			
Item	***Description***	***Operation***	***Display***
Service Mode	1. Viewing/setting indoor unit option code 2. Viewing/setting indoor unit MAIN address 3. Viewing/setting indoor unit RMC address 4. Viewing indoor unit cycle data 5. Setting/Viewing temperature sensor compensation of the wired remote controller (-9°F~ +9° F) 6. Viewing RPM compensation 7. Viewing/setting EEV stop step when indoor unit is thermal-off during heating mode 8. Viewing/setting filter reminder time interval (1000 hours, 2000 hours) 9. Viewing/setting indoor unit temperature sensor compensation during Heating (+2°F or +5°F) 10. Viewing the H/W option setting 11. Viewing wired remote controller software version 12. Viewing/setting individual louver lock 13. Viewing indoor unit status 14. Power Master Reset 15. Resetting ODU (K3) 16. Automatic air volume enable and status viewing (for supported indoor units)	Each Unit	Each Unit
Blade	Setting individual blade positions on 4-Way Cassette (AM0**RN4DCH/AA, AC0**NN4DCH/AA, AJ0**TNNDCH/AA, JNH***NDT)	Each Unit	Each Unit
Error	When an error is currently occurring in the system, the afflicted unit and the error code are displayed	Each Group	Each Group
Permit / Prohibit Local Operation	Setting/releasing of simplified locking of remote control buttons	Each Group	N/A
Quiet Mode	Select the quiet mode to lower the fan noise level (for supported units)	Each Group	N/A

Multi-Function Controller			
Item	***Description***	***Operation***	***Display***
Room Temperature	Actual room temperature or set temperature can be displayed	Each Group	Each Group
Energy and Usage	1. Display instantaneous power (current power use), weekly usage, monthly usage, and yearly usage, in graph format with year-over-year display option. a. The weekly display follows ISO 8601 standards. 2. Display weekly operating time, monthly operating time, yearly operating time, in graph format with year-over-year display option. 3. Target energy consumption and target operating times can be specified. When energy consumption or operating time has exceeded the target(s), an alarm popup will appear for notification.	Each group	Each group

**Some features may not be available depending on the model of connected air handler(s).*

***The WindFree™ unit delivers an air current that is under 0.15 m/s while in WindFree™ mode. Air velocity that is below 0.15 m/s is considered "still air" as defined by ASHRAE 55-2013 (American Society of Heating, Refrigerating, and Air-Conditioning Engineers).*

Section 26 0500
Common Work Results for Electrical

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section Includes:
1. Materials and equipment shall be furnished and installed in support of electrical work described in these plans and specifications including but not limited to, raceways, boxes, enclosures, feeders, branch circuiting, supports, terminal cabinets, sleeves, gutters, panels, transformers, switchgear, lighting fixtures, controls, relays, contactors, in order to complete and make fully functional the systems described.
2. Complete fire alarm and annunciation system as shown and/or required by the (local jurisdiction having authority, California State Fire Marshal) including monitoring equipment and wiring for central station connection. Provide fire alarm system design and submit for approval by the AHJ.
3. Lighting systems, both interior and exterior as shown on the plans and as specified herein, including controls, occupancy sensors, lumen sensors, photocell controls, lamps, dimmers, racks, dimming ballasts, supports, fasteners, straps, and miscellaneous mounting hardware and support structures for such equipment.
4. HVAC and plumbing electrical: Conduit, conductors and terminations for all line voltage power, line voltage controls and fusible and/or non-fusible safety disconnect switches for HVAC equipment, including but not limited to air conditioners, furnaces, fans, heat pumps, cooling towers, system pumps, condensing units. Provide protective equipment unless otherwise noted, etc. including protective devices.
5. Power and Lighting Distribution: Furnish and install power and lighting distribution systems including but not limited to panels, feeders, transformers, branch circuits, devices, fixtures, disconnect switches, contactors, controls, etc. for a complete working system.
6. Data systems infrastructure including all boxes, raceways, cable tray, wire basket tray, dedicated branch circuits, sleeves and penetrations, etc. as described and as shown in plans, risers, specifications, EIA/TIA standards and/or required for a complete and operating system.
7. Lighting acceptance testing, documentation and completion of required forms as specified in Section 26 5670, LIGHTING ACCEPTANCE TESTING.
8. Allocation of time to adequately train the Owner on the use and operation of all systems installed within the facility or on the property. Minimum two week advance notice shall be coordinated with the Owner and his representatives. Training shall be as outlined in individual system specifications identified to follow.

B. Related Sections Under Other Divisions:
   1. Mechanical Wiring: Control circuit wiring, energy management controls and interlocks for mechanical equipment shall be installed by Mechanical Contractor.
   2. Painting of electrical equipment where exposed and required by the Architect to be painted as described elsewhere in the specification.
   3. HVAC Control Raceway: Raceways, boxes, and control wiring for thermostats, temperature sensors and control components specified within the mechanical specifications, shall be furnished and installed as required by Division 25 and installed in accordance with the minimum wiring methods allowed for branch circuit wiring in Division 26 (the DDC systems/EMS systems and components are installed in accordance with Division 25).

1.3 SYSTEM DESCRIPTION

A. The electrical plans indicate the general layout and arrangement; the architectural drawings and field conditions shall determine exact locations. Field verify all conditions and modify as required to satisfy design requirements as well as code minimums. Maintain all required working clearances as described in CEC Article 110 as well as other applicable articles.

B. Discrepancies shall be brought immediately to the attention of the Architect for clarification. The Architect shall approve any changes. Prior to rough-in, refer to architectural plans that shall take precedence over electrical plans with respect to locations.

C. Verify all power and communications utility company requirements prior to commencement of utility work. Make proper adjustments to the construction to satisfy the serving utility requirements if they differ from the construction documents. It shall be the Contractor's responsibility to contact each utility company for obtaining finalized utility design drawings and/or approval, and for scheduling inspection of utility infrastructure installations.

D. Charges imposed by the electric and communications utility companies shall be paid by Owner directly to utility companies.

1.4 SUBMITTALS AND SHOP DRAWINGS

A. Before construction, submit in (accordance with the General Conditions of this Specification) a complete list of all materials proposed to be furnished and installed under this section. Any material procured without review and approval of the engineer and/or owner's representative, will solely be at the contractor's risk.

B. Manufacturers' specifications, catalog cuts and shop drawings as required to demonstrate compliance with the specifications. Identify specific intended use for each component where submittal may be ambiguous. Submit entire bound submittal at one time; partial submittals will not be accepted. At a minimum, submittals will be required for the following:
   1. Electrical equipment including disconnects, fuses, raceways, straps and racks, fittings, conductors, boxes, gutters, devices, plates, etc.
   2. Lighting equipment including fixtures, ballasts, lamps, mounting accessories, color charts (where required), etc.

3. Lighting control equipment including low voltage switching system, dimmer switchbank / accessories, occupancy sensing equipment, time clocks, contactors, photocells, lumen sensors, etc.
4. Constructability review letter/comments for lighting acceptance testing as required by Section 26 5670, LIGHTING ACCEPTANCE TESTING.
5. Complete system component submittals and shop drawings for:
   a. Fire Alarm System
   b. Communication Systems including but not limited to; cable, fiber, terminations, cable management, cable tray, patch panels, equipment racks, specified active electronics (where called for), cabinets, jacks, plates, cable labeling, testing procedure.
6. Conduit including all fittings, etc.
7. Wiring and cable, terminations, etc.

C. The intent of these specifications is to establish a standard of quality for materials and equipment. Therefore, some items are identified by manufacturer or trade name designation. Substitutions shall be subject to the Architect's approval. Samples of the proposed and substitute materials may be required for inspection prior to approval. Costs, if any, for evaluation of substitutions shall be the Contractor's responsibility. The decision of the Architect shall be final. Where the substitution will affect other trades, coordinate all changes with those trades concerned and pay any additional costs incurred by them as a result of this substitution. Approval of substitutions shall not relieve the Contractor from providing an operational system in accordance with all applicable codes and ordinances.

1.5 DELIVERY, STORAGE AND HANDLING

A. Storage of equipment for the job is the responsibility of the Electrical Contractor and shall be scheduled for delivery to the site, as the equipment is required. Damage to the equipment delivered to the site or in transport to the job shall be the responsibility of the Electrical Contractor.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials shall be new and bear the label of or be listed by a nationally recognized testing laboratory. The quality and suitability of all materials shall conform to the standards and practices of this trade.

B. Supplied materials shall be of a current manufactured product line. Discontinued products are not acceptable. Where products are identified on the contract documents by part number, supply the current product model or series which meets the specification and intended use of the specified component.

2.2 SUPPORTING DEVICES

A. Hangers: Kindorf B-905-2A Channel, H-119-D washer, C105 strap, 3/8" rod with ceiling flange.

B. Pipe Straps: Two-hole galvanized or malleable iron.

C. Luminaire Chain: Campbell Chain 75031, 90-lb. test with steel hooks.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Professionalism and appearance of installations shall be in accordance with accepted practices of this trade. Installation methods shall conform to manufacturers' specifications and recommendations. The Contractor shall man the job with qualified journeymen and helpers in this trade for the duration of the job. It is the Contractor's responsibility to communicate with and keep the job superintendent appraised of changes or clarifications, etc.

B. Employment of any person on any job in the capacity of an electrician is not permitted unless such person has qualified for and holds a valid Journeyman Electrician Pocket Card or General Journeyman Electrician Certificate issued by the State of California Division of Apprenticeship Standards except, Contractor may employ electrical helpers or apprentices on any job of electrical construction, new or existing, when the work of such helpers or apprentices is performed under the direct and constant personal supervision of a journeyman electrician holding a valid Pocket Card accepted by the State of California Division of Apprenticeship Standards.
   1. Each Pocket Card carrying journeyman electrician will be permitted to be responsible for the quality of workmanship for a maximum of one helper or apprentice during any same time period, provided the nature of work is such that good supervision can be maintained and the quality of workmanship is the best, as expected by Owner and implied by the latest edition of the National Electrical Code.
   2. Before each journeyman electrician commences work, deliver to Owner at the project site, a photocopy of the journeyman's valid Pocket Card.

C. Materials shall be installed in accordance with the manufacturers' specification and recommendations. They must conform to the approval AHJ adopted codes and standards, but not less than the 2022 CEC and all applicable codes and standards, including but not necessarily limited to California Code of Regulations Title 24, NFPA, National Electrical Manufacturers Association, ANSI, CBC, and any other adopted ordinances of applicable agencies having jurisdiction. Refer to general conditions of specifications.

D. Electrical Contractor shall lay work out in advance in order to avoid unnecessary cutting, chasing, and drilling of floors, walls, ceilings and other surfaces. Work of this nature shall be carefully done so as not to damage work already performed by other trades. Any damage which results must be properly repaired at no extra cost to the Owner. Such alterations shall not depreciate the integrity of the structure. Approval for cuts or penetrations in structural members shall be by the Architect.

E. Supporting Devices:
   1. Verify mounting height of all luminaires or items prior to installation when heights are not detailed.
   2. Install vertical support members for equipment and luminaires, straight and parallel to building walls. Provide independent supports to structural member for electrical luminaires, materials, or equipment installed in or on ceiling, walls or in void spaces or over furred or suspended ceilings.
   3. Do not use other trade's fastening devices as supporting means for electrical equipment, materials or luminaires. Do not use supports or fastening devices to support other than one particular item.
   4. Support conduits within 18" of outlets, boxes, panels, cabinets and deflections. Maximum distance between supports not to exceed 8' spacing.
   5. Securely suspend all junction boxes, pull boxes or other conduit terminating housings located above suspended ceiling from the floor above or roof structure to prevent sagging and swaying.
   6. Provide seismic bracing per UBC requirements for this building location.
   7. Supporting Devices: Safety factor of 4 required for every fastening device or support for electrical equipment installed. Support to withstand four times weight of equipment it supports. Bracing to comply with seismic design category "SDC" per Structural Engineer.

F. Coordinate work with other trades as required to eliminate any delays during construction. Coordinate changes with other prime contractors to avoid construction conflicts.

G. Engineer's Field Observation: Site visits during construction for field observations and reports will be conducted by electrical engineer when directed by the Architect. A list of items that need to be addressed will be submitted to the Architect for forwarding to the Contractor. A written response to all items shall be submitted for Owner's review once complete. When Electrical Engineering representative performs a field observation, the Electrical Contractor shall be present and available to remove equipment covers as needed.

H. Drawings of Record: Provide a full and accurate set of field record drawings marked up in a neat and understandable manner submitted to the Owner Representative, Construction Manager, or Architect upon completion of the work and prior to issuance of a certificate of completion. The drawings shall dimension all electrical facilities including but not limited to underground conduit, vaults, boxes as well as conduit routing scaled to within 12" of actual field conditions and shall be kept up to date on a daily basis reflecting changes or deviations. Electrical facilities shall be accurately drawn on the plan to scale. Refer to the general conditions of these specifications for additional requirements. Record drawings shall be required to identify both horizontal and vertical dimensions to visible and fixed points such as concrete, asphalt, buildings, sidewalks, etc.

I. Safety: The Electrical Contractor is responsible to maintain equipment in a safe and responsible manner. Keep dead front equipment in place while equipment is energized. Conduct construction operations in a safe manner for employees as well as other work persons or anyone visiting the job site. Provide barriers, trench plates, flags, tape, etc. The Contractor shall hold all parties harmless of negligent safety practices that may cause injury to others on or near the job site.

J. Guarantees: Equipment and labor shall be guaranteed and warranted free of defects, unless otherwise stated to be more restrictive, for a period of one year from the date of final acceptance by the Owner. A written warranty shall be presented to the Architect at the time of completion prior to final acceptance. Equipment deemed to be damaged, broken or failed should be repaired or replaced at no additional cost to the Owner. Materials or system requiring longer than a one-year warranty as described herein shall be separately warranted in separate letters of guarantee stating the duration of warranty.

K. Operating and Installation Manuals: Provide two copies each of manuals, operating and installation instructions for equipment indicated in submittal packages. Instruct the Owner's representative as to the operation and location of equipment necessary to allow them to operate the facility upon final acceptance. This instruction period shall be prearranged with the Owner's representative prior to occupancy of the facility and the weeks prior to training scheduled.

L. Lighting Acceptance Testing: Provide two copies of lighting acceptance testing results and equipment operating manuals as specified in Section 26 5670, LIGHTING ACCEPTANCE TESTING. Instruct the Owner on operation of control systems.

END OF SECTION 26 0500

Section 26 0501
Selective Electrical Demolition

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section Includes:
1. Electrical demolition.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work shall be as specified in individual sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor to walk job to observe existing conditions and account for variance as needed.

B. Verify field measurements and circuiting arrangements as shown on drawings.

C. Verify that abandoned wiring and equipment serve only abandoned facilities.

D. Demolition Drawings are based on limited field observation and existing record documents. Report discrepancies to Owner/Architect before disturbing existing installation.

3.2 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.

B. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, observe provisions of NFPA 70E and CALOSHA, use personnel experienced in such operations.

C. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area as required.

D. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Coordinate outages with Owner and local fire service. Notify Owner/Owner's representative at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

E. Existing Telephone System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Notify Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Demolish and extend existing electrical work under provisions of this section.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Allow the owner first right to retain ownership of salvaged materials, otherwise the Electrical Contractor is responsible for its removal from the site and proper disposal or recycling.

D. Remove abandoned wiring to source of supply.

E. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

F. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.

G. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

H. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

I. Discarded electrical components and lamps containing hazardous waste (i.e., mercury in fluorescent lamps) shall be disposed of as required by the State Laws and Local Ordinances regarding hazardous materials.

J. Repair adjacent construction and finishes damaged during demolition and extension work.

K. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

L. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.4 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

B. Luminaires: Cleaning light fixtures. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace ballasts and broken electrical parts as required for any inoperative fixtures. Provide new lamps for all fixtures that are to remain.

3.5 INSTALLATION

A. Install relocated materials and equipment as shown and/or as required.

END OF SECTION 26 0501

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Section 26 0519
Low Voltage Electrical Power Conductors and Cables

SECTION 26 0519 – LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Wires and cables.
2. Connectors.
3. Lugs and pads.

1.3 SYSTEM DESCRIPTION

A. Provide wires, cables, connectors, lugs, strain reliefs, racking insulators for a complete and operational electrical system.

1.4 SUBMITTALS

A. Submit in accordance with Section 26 0500, COMMON WORK RESULTS FOR ELECTRICAL.

B. Provide product data for the following equipment:
1. Wires.
2. Cables.
3. Connectors.
4. Lugs.
5. Splice Kits.
6. Cable Racking and Insulators.

C. Provide the insulation cable testing report in the project closeout documentation, refer to Closeout Requirements in the General Conditions portion of this specification.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of the CEC, latest adopted version with amendments by local Authority Having Jurisdiction (AHJ).

B. Furnish products listed by UL or other testing firm acceptable to AHJ.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Wires and Cables: General Cable, Okonite, Southwire, or approved equal.

B. Connectors: Burndy, Ilsco, Thomas & Betts, or approved equal.

C. Wire connectors shall be minimum 75 degree centigrade rated and properly sized for the number of conductors being connected, terminated, spliced etc. All above grade connectors shall be solderless lug or plastic wire nut type, screw on, pressure cable type (wire nut or spring nut type), 600 volt, 105 degree C, with skirt to cover all portions of stripped wires. Connector shall be U.L. rated for number and size of conductors being joined together as a splice.

D. Splices:
1. Branch Circuit Splices: Ideal, Scotch-Lock, 3M, or approved.
2. Feeder Splices: Compression barrel splice with two layers Scotch 23 and four layers of Scotch 33+ as vapor barrier.
3. Screw Terminal Lugs.
4. Kearney Split Bolt.

2.2 WIRES AND CABLES FOR LINE VOLTAGE SYSTEM AND CONTROLS. WIRE AND CABLE SHALL BE:

A. Copper, 600 volt rated throughout. Conductors 14AWG to 10AWG, solid or stranded. Conductors 8AWG and larger, stranded.

B. Phase color to be consistent at all feeder terminations; A-B-C, top to bottom, left to right, front to back. Phasing tape shall be permitted on sizes #6 and larger.

C. Color Code Conductors as Follows:

PHASE	208 VOLT
A	Black
B.	Red
C.	Blue
Neutral	White
Ground	Green
Isolated Ground	Green w/yellow trace

D. All conductors shall be copper unless otherwise noted. Minimum size for individual conductors shall be #12 AWG unless otherwise noted. Sizes #8 AWG and larger shall be stranded conductor. Individual conductors shall be insulated with type, XHHW, THW, THHN/THWN 600-volt insulation unless otherwise noted. Control, signal, communication conductors shall be as dictated by the vendor of that equipment or as specified here-in. Proper insulation type shall be used for the proper environmental application (i.e., waterproof, wet location, plenum,

temperature rated). If a condition exists where the application is uncertain, contact the Engineer for direction. Contractor is responsible to follow specific cabling requirements described in other sections of this specification relative to various communications and controls systems as well as the respective riser diagrams shown on plans. If a discrepancy occurs, communicate such discrepancy to the Architect and Engineer immediately for resolution.

E. Insulation types THWN, THHN or XHHW. Minimum insulation rating of 90C for branch circuits.

F. Refer to signal and communications specification sections for cable requirements.

2.3 CONNECTORS

A. Copper Pads: Drilled and tapped for multiple conductor terminals.

B. Lugs: Indent/compression type for use with stranded branch circuit or control conductors.

C. Solid Conductor Branch Circuits: Spring connectors, wire nuts, for conductors 18 through 8AWG.

2.4 LUGS AND PADS

A. Ampacity: Cross-sectional area of pad for multiple conductor terminations to match ampere rating of panelboard bus or equipment line terminals.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation: Conductors shall not be installed until after conduit systems are permanently in place. Use an approved non hardening type wire pulling lubricant if lubricant is to be used. Maintain all conduits and wire pulls free from foreign material. If due to field conditions, more than a total of 300 degrees of bend are required; a pull box shall be furnished and installed for ease of installation. Said pull boxes must be sized and rated for the appropriate application and must remain easily accessible upon completion of the project (approval of the location shall be obtained from the Architect prior to installation). Show these pullboxes on the field record drawings. Conductors installed in underground raceways on site shall be duct sealed and taped where they exit the raceway to prevent the entrance of foreign material and moisture after the conductors are installed. Proper drainage shall be provided for underground pull and splice boxes.

B. Insulation: Use proper insulation types where temperature and environment are a factor.

C. Splices at or below grade level shall be made with wet location rated and approved mechanical connectors and shall be encapsulated in epoxy or plastic molded poured kits. The connections must be assured to be watertight. Splices at or below grade shall always be avoided and

minimized. Prior approval is required for feeder splices below grade. Submit proposed materials and exhibit showing location of intended splices for Engineer's review and approval prior to commencing with the work.

D. Labeling: All conductors in panels, switchboards, terminal cabinets, vaults, pull boxes, and junction boxes shall be labeled with tape number markers indicating circuit number and identifying system. All labeling shall be permanent. In manholes and vaults, provide embossed brass tags identifying system serviced and function. See Section 26 0553 IDENTIFICATION OF ELECTRICAL SYSTEMS.

E. All conductors, wiring, cable where installed below floor, slab or underground shall be considered wet locations, and shall be rated accordingly. Non waterproof cabling is not allowed in any below grade or wet application.

F. Cables routed together in cable tray shall be stacked, organized and tie wrapped together in a neat and workman like manner. Random cable routing is not acceptable.

G. Cable and conductors routed through pull boxes and vaults shall be properly supported on porcelain or equal insulators mounted on steel rack inserts. Bend radius of cable or conductor shall not be less than six times the overall cable diameter.

H. Wires and Cables:
   1. Conductor Installation:
      a. Install conductors in raceways having adequate, code size cross-sectional area for wires indicated.
      b. Install conductors with care to avoid damage to insulation.
      c. Do not apply greater tension on conductors than recommended by manufacturer during installation.
      d. Use of pulling compounds is permitted. Clean residue from exposed conductors and raceway entrances after conductor installation.
   2. Conductor Size and Quantity:
      a. Install no conductors smaller than 12AWG unless otherwise shown.
      b. Provide all required conductors for a fully operable system.
   3. Provide dedicated neutrals (one neutral conductor for each phase conductor) in the following single phase circuits:
      a. Dimmer controlled circuits.
      b. Isolated ground circuits.
      c. Ground fault and arc fault protected circuits where a GFI and arc fault breakers are used in panelboards.
      d. Other electronic equipment which produces a high level of harmonic distortion including but not limited to computers, printers, plotters, copy machines, fax machines, where indicated.
   4. Conductors in Cabinets:
      a. Cable and train all wires in panels and cabinets for power and control neatly and uniformly. Use plastic ties in panels and cabinets.
      b. Tie and bundle feeder conductors in wireways of panelboards.
      c. Hold conductors away from sharp metal edges.
      d. Connectors: Retighten mechanical type lugs and connectors for conductors to equipment prior to Notice of Completion.

3.2 FIELD QUALITY CONTROL

A. Tests:

1. Test conductor insulation on feeders of 400 amp and greater for conformity with 1000 volt megohmmeter. Use Insulated Cable Engineers Association testing procedures. Minimum insulation resistance acceptable is 1 megohm for systems 600 volts and below.

2. Test Report: Prepare a typed tabular report indicating the testing instrument, the feeder tested, amperage rating of the feeder, insulation type, voltage, the approximate length of the feeder, conduit type, and the measured resistance of the megohmmeter test. Submit report with operating and maintenance manual.

END OF SECTION 26 0519

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Section 26 0529
Hangers and Supports for Electrical Systems

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

B. Related Sections include the following:
1. Section 26 0548 "Vibration and Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3 SUBMITTALS

A. Submit in accordance with Section 26 0500, COMMON WORK RESULTS FOR ELECTRICAL.

1.4 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.5 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.6 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Steel slotted support systems.
   2. Nonmetallic slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
   1. Trapeze hangers. Include Product Data for components.
   2. Steel slotted channel systems. Include Product Data for components.
   3. Equipment supports.

1.7 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.8 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.9 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Allied Tube & Conduit.

b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut; Tyco International, Ltd.
g. Wesanco, Inc.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
4. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1) Hilti Inc.
2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
3) MKT Fastening, LLC.
4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1) Cooper B-Line, Inc.; a division of Cooper Industries.
2) Empire Tool and Manufacturing Co., Inc.
3) Hilti Inc.
4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
5) MKT Fastening, LLC.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.

6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
1. Secure raceways and cables to these supports with two-bolt conduit clamps.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.

3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. 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.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 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 minimum dry film thickness of 2.0 mils (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 0529

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Section 26 0533
Raceways and Boxes for Electrical Systems

SECTION 26 0533 – RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Conduit and fittings.
2. Outlet boxes.
3. Junction and pull boxes.
4. Cabinets, termination cabinets.
5. Gutters.

B. Related Work:
1. Installation of all wire, cable, conductor, boxes/gutters, pull ropes, fiber optic cable raceway, conduit, innerduct, cable sleeve and duct as described on the plans and/or as specified here-in. This scope shall include pathways to be installed underground on site and offsite, underslab, above grade, both concealed and exposed, overhead concealed and exposed as appropriately applied. Raceways/boxes shall be installed in accordance with their intended and allowed uses and as specified here-in whichever is more restrictive. Size and capacity of all raceway/boxes shall be as specified here-in or as depicted on the drawings, but shall not be less than that required by code. Larger raceway sizes may be specified than code would permit. The specifications shall govern.
2. Listed products for termination, coupling, extending, benching supports of raceways shall be used.
3. Raceways/boxes described by this section shall include, but not be limited to, power for site utilities and lighting, site and building communications, controls, fire alarm, security, access control, sound systems, data system, energy management systems, power distribution, lighting, lighting controls, video, CATV, voice communications, intercom, nurse call, HVAC and other building low voltage/communications systems controls as may be required. Raceways, boxes and duct paths required for utility companies shall be installed per plans unless utility company requirements are more restrictive at which time those requirements shall take precedence.
4. Protection of and cleanliness of pathways and raceways must be assured during the construction process in order to eliminate the possibility of debris entering the conduit, duct, pathway resulting in decreased wire capacity and potential damage to installed conductors and cables.

5. Pathways are shown in a diagrammatic way and are generally accurate as to routing, however, it is the Contractor's responsibility as a means and methods process to coordinate with all other trades that require space within a building. The Contractor shall obtain approval for installation of raceways routing through structural footings, retaining walls, columns, beams, purlins, grade beams, etc.
6. It is the Contractor's responsibility to ensure that all raceway and boxes systems penetrate fire assemblies and sound rated assemblies in an approved manner using the appropriate and listed products for the purpose.
7. Trenching and backfilling for all underground conduit systems installed by the Electrical Contractor shall be the responsibility of the Contractor. Conduits shall have minimum cover requirement of 36" below finish grade with the exception of site lighting conduits which may be 24" below finish grade minimum. More stringent depth requirements may be imposed by the local agency and utility company and shall be adhered to, and / or this specification or as detailed on the plans. Joint trenching may be utilized where practicable and where permitted by this specification. Concrete, native material and sand shall be used as backfill material and shall be compacted in accordance with and coordinated with the grading and site preparation requirements. Conduits shall rest in a minimum of 4" bed of sand prior to backfill and compaction. Locations of existing underground (UG) utility systems shall be determined by calling Underground Service Alert (USA) at least 48 hours prior to any excavation. Also refer to Section 26 0546.13, ELECTRIC UTILITY SYSTEMS.
8. Minimum conduit size shall be 1/2" except if plan shows or code requires larger size. Exception: Use minimum 3/4" for underslab and below grade applications outside of building exterior walls.
9. All electrical, control, communications systems shall be installed in conduit system. This shall include but not be limited to all systems described in Section B.3 above, except for voice and data systems which shall be installed as described on these plans and as specified here-in but shall not be less than the recommendations of EIA/TIA standards.
10. All line voltage wiring within the building shall be installed in metallic conduit.
11. All conduit, concrete pads, underground concrete or fiberglass substructures shall be furnished and installed with the approved materials and type for the application. Provide proper traffic control during construction as well as barriers and protection of all excavations and trenching.
12. Empty or future conduits shall be properly plugged with plastic caps or inserts with a 3/8" polyethylene pull rope. Plastic or "duct" tape will not be acceptable.
13. Exterior installations: After conductors are installed, seal conduit ends to prevent entrance of foreign material using pliable duct seal, caps or waterproof expanding foam.
14. All low voltage systems including intercom, fire alarm, public address, etc. shall be in dedicated conduit systems. Voice / Data and Direct Digital Control (DDC) systems for HVAC cabling shall be routed as specified in Section 27 1300, INTERCOMMUNICATIONS SYSTEMS and as recommended by EIA/TIA standards. It shall be the contractor's responsibility to provide raceway down walls to outlet boxes and to provide sleeves across inaccessible ceiling spaces.
15. No single conduit run of any type shall exceed 300 degrees of radius bend from termination box to termination box.
16. Separate Raceway System: Provide a separate dedicated raceway system for each system installed, do not combine different systems into a raceway or cable tray system, unless otherwise noted or allowed.

17. Outlet System: Provide electrical boxes and fittings as required for a complete installation. Including but not limited to outlet boxes, junction boxes, pull boxes, bushings, locknuts, covers and all other necessary components.
18. Code Compliance: Comply with CEC as applicable to construction and installation of electrical boxes and fittings and size boxes according to CEC 312, 314 and 366 except as noted otherwise.
19. Outlets to be flush mounted: Maintain integrity of insulation and vapor barrier. Unless otherwise noted, flush mount all outlet boxes.
20. Provide putty pads of proper type around outlet boxes and/or as detailed on plan to meet sound transmission restrictions and fire ratings of walls.

1.3 SUBMITTALS

A. Provide Shop Drawings and Product Data for the Following Equipment:
1. Conduit and fittings.
2. Outlet boxes.
3. Junction and pull boxes.
4. Cabinets, termination cabinets.
5. Putty pads.
6. Raceways

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of the CEC, latest adopted version with amendments by local AHJs.

B. Furnish products listed by UL or other independent and nationally recognized testing firm.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Heavy wall Rigid Non-Metallic Conduit, shall be PVC schedule 40 manufactured in accordance with NEMA Standard TC-2, UL-651 and WC 1094A specifications.

B. Extra heavy wall non-metallic conduit, shall be PVC schedule 80 manufactured in accordance with NEMA Standard TC-2, UL-651 and WC 1094A specifications.

C. Galvanized Rigid Steel (GRS) conduit shall be hot dipped galvanized, zinc coated and shall comply with Underwriters Laboratories UL-6, ANSI Specification C-80.1 and Federal Specification WW-C-581E.

D. Electrical Metallic Tubing (EMT) shall be zinc coated, with a protective coating applied to the inside surface and shall comply with Underwriter Laboratories UL-797 ANSI Specification C-80.3 and Federal Specification WW-C-563A.

E. Electrical Non-Metallic Tubing (ENT), shall be listed to requirements of U.L. 1653, in accordance with CEC Article 362, and meet requirements of BI National Standard CAN/CSA-C22.2 No. 227.1-U.L. 1653. ENT shall be rated for 90 degrees C conductors and shall be recognized for use in 2-hour fire resistance non-load bearing and load bearing wall assemblies. ENT shall be recognized for through-penetration firestop systems as classified to meet U.L. and ICC building codes.

F. Flexible Metal Conduit (FMC) shall be continuous wound reduced wall galvanized steel produced to UL standards.

G. Liquid tight flexible metal conduit shall have a thermoplastic cover over a galvanized steel core containing an integral copper ground in sizes to 1 1/4" and shall be in compliance with UL standards and CEC Article 350.

H. Wire basket tray shall be 9" wide with 3" side rails unless otherwise noted. It shall be U.L. listed and use listed connectors, elbows, tees, etc. and be cut and installed using listed equipment. Material shall be zinc electroplated steel.

I. Cable runway tray shall be 12" wide with 4" side rails unless otherwise noted. It shall be U.L. listed and use listed connectors, elbows, tees, etc. Material shall be hollow steel with gray painted finish.

J. Manufacturers:
1. Outlet Boxes: Bowers, Raco, Steel City or equal.
2. Junction and Pull Boxes: Circle AW, Hoffman, Wireguard or equal.
3. Box Extension Adapter: Bell, Red Dot, [Carlon] or equal.
4. Conduit Fittings: O-Z Gedney, Thomas & Betts, or equal.
5. Putty pads: 3M, Hilti, or equal.
6. Heavy wall rigid non-metallic conduit, Carlon, Certainteed, R&G Sloane or equal.
7. Extra heavy wall non-metallic conduit, Carlon, Certainteed, R&G Sloane or equal.
8. Galvanized Rigid Steel (GRS) conduit shall be hot dipped galvanized, zinc coated and shall comply with Underwriters Laboratories UL-6, ANSI Specification C-80.1 and Federal Specification WW-C-581E.
9. Electrical Metallic Tubing (EMT) shall be zinc coated, with a protective coating applied to the inside surface and shall comply with Underwriter Laboratories UL-797 ANSI Specification C-80.3 and Federal Specification WW-C-563A.
10. Electrical Non-Metallic Tubing (ENT), shall be listed to requirements of U.L. 1653, in accordance with CEC Article 362, and meet requirements of BI National Standard CAN/CSA-C22.2 No. 227.1-U.L. 1653. ENT shall be rated for 90 degrees C conductors and shall be recognized for use in 2-hour fire resistance non-load bearing and load bearing wall assemblies. ENT shall be recognized for through-penetration firestop systems as classified to meet U.L. and ICC building codes.
11. Flexible Metal Conduit (FMC), Alflex, American Flexible Conduit or equal.
12. Liquid tight flexible metal conduit, Anacanda (type UA), Electri-flex Liquatite or equal.
13. Surface mount raceway, Wiremold, Three Compartment Series 5500 or equal
14. Wire basket tray, B-line, GS Metals, Cablofil or equal.
15. Cable runway tray, B-line, CPI, Homaco or equal.

2.2 OUTLET BOXES

A. NEMA 1 gutter, junction and pull boxes shall be fabricated from code gage steel finished in grey enamel with screw cover fronts and concentric knockouts in all sides.

B. Steel outlet boxes and plaster rings shall be galvanized rigid assemblies, either one piece pressed or factory welded construction containing the size and number of knockouts required. Steel outlet boxes shall be manufactured, sized and installed in accordance with CEC Article 314. Device Outlet: Installation of one or two devices at common location, minimum 4" square, minimum 1 1/2" deep. Single or 2 gang flush device plaster ring. Raco Series 681 and 686 or equal.

C. Luminaire Outlet: minimum 4" square with correct plaster ring depth, minimum 1 1/2" deep with 3/8" luminaire stud if required. Provide proper depth plaster ring on bracket outlets and on ceiling outlets.

D. Multiple Devices: Three or more devices at common location. Install 1 piece gang boxes with 1 piece device plastering. Install one device per gang unless otherwise allowed.

E. Construction: Provide galvanized steel interior outlet wiring boxes, of the type, shape and size, including depth of box, to suit each respective location and installation; constructed with stamped knockouts in back and sides, and with threaded holes with screws for securing box covers or wiring devices. Boxes shall be properly secured to the structure such that they are flush with the finish surface. Boxes shall be made structurally secure by means of the proper fastening devices.

F. Accessories: Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, plaster rings, luminaire studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual wiring situations.

2.3 JUNCTION AND PULL BOXES

A. Construction: Provide galvanized sheet steel junction and pull boxes, with screw-on covers; of the type shape and size, to suit each respective location and installation; with welded seams and equipped with steel nuts, bolts, screws and washers.

B. Location:
1. Install junction boxes above accessible ceilings for drops into walls for receptacle outlets from overhead.
2. Install junction boxes and pull boxes as required to facilitate the installation of conductors and limiting the accumulated angular sum of bends between boxes, cabinets and appliances to 300 degrees.
3. Locations: Junction boxes shall be located only where necessary and only in equipment rooms, closets, and accessible attic and underfloor spaces. A horizontal distance of 24" shall separate outlet boxes on opposite sides of occupancy separation walls, fire-rated walls or partitions.
4. Labeling: Junction box covers shall be marked with indelible ink indicated the circuit numbers passing through the box.

2.4 BOX EXTENSION ADAPTER

A. Construction: Diecast aluminum or cast iron with gasket.

B. Location: Install over flush wall outlet boxes to permit flexible raceway extension from flush outlet to fixed or movable equipment.

2.5 CONDUIT FITTINGS

A. Requirements: Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts and plastic conduit bushings of the type and size to suit each respective use and installation.

B. Steel boxes may allow for field knock-out modifications, but shall in all other ways conform to code requirements.

2.6 PUTTY PADS

A. Intumescent moldable firestop putty designed to protect electrical outlet boxes.

B. Designed to install around outside of outlet boxes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Conduit systems listed below are for use in installations where they are permitted to be used by CEC and/or other occupancy restrictions. The below installation methods do not intend to suggest that these materials be installed in conflict with any applicable code. Special attention to applications shall be made in building types such as Educational, Health Care, wet location, hazardous locations, assembly occupancy and multi-story, but not limited to these. Requirements which are more restrictive than the CEC may be called for by the drawings and / or these specifications. These requirements must be adhered to. The Electrical Contractor shall be responsible to use the proper conduit system for the application. Exposed conduit is not allowed below ceilings or above slab of floor, without the permission and approval of the Architect. All conduits shall be concealed except in electrical and telecommunication rooms or where shown to be surface mounted. Exposed conduit (where allowed) shall be run square and plumb with building lines in an approved manner. Support roofmount conduits, where allowed, with minimum 12” wide redwood blocks set in mastic unless otherwise detailed in roof requirements or as specified in roofing specification, by the Architect. Strap conduits to blocks with proper sized conduit straps. Spacing of support shall be a minimum as provided for in the CEC. All exposed conduit mounted below 8’ above finished grade shall be strapped at a minimum of 5’ spacing.

B. Non-Metallic Rigid Conduit shall be used in concrete slabs, below concrete slabs on grade, or underground outside of a building slab or foundation. Maintain minimum depth requirements

and cover with appropriate fill material. Minimum 4” of bedding and cover of backfill material 1/4" size grain and smaller maximum. Conduit shall be heavy wall Schedule 40 or 80, rigid PVC only. Rigid utility P&C duct shall not be used in any application. Properly sized grounding conductors shall be installed per CEC article 250, in all non-metallic conduit branch circuit and feeder runs. PVC conduit shall be formed or field bent only with the use of properly approved bending tools such as to not decrease the internal bore of the conduit. All conduits shall be cut square and reamed of burrs. Approved and compatible glue shall be used on all PVC fittings to attain watertight joints. All non-metallic conduit runs over 150’ in length and over 1 1/4" trade size conduit shall utilize galvanized rigid steel elbows.

C. Galvanized Rigid Steel (GRS) conduit shall be used where exposed less than 8’–0” above finished grade to 18” below finished grade and where subject to physical damage. Conduits shall be cut square and reamed to remove burrs and sharp edges. Strap conduit below 8’ above grade at 5’ intervals. Unless otherwise noted, threadless setscrew and threadless weathertight fittings may be used in lieu of threaded fittings. All threaded ends entering a junction box of any type shall require one locknut on the inside and one on the outside of the enclosure and be provided with a plastic bushing or grounding bushing where necessary for proper grounding. Where exposed to moisture, a watertight hub or other approved method shall be required. All conduits shall be stubbed up straight and uniform into junction boxes, panels, cabinets, etc., and shall be (GRS) properly supported and strapped. All GRS conduit located below grade, shall be tape wrapped.

D. Electrical Metallic Tubing (EMT) shall be used as allowed by code and as permitted by this specification. It shall not be in contact with soil or the concrete slab on the ground floor of any structure. Connectors and couplings shall be steel, insulated set screw type where installed in indoor dry locations not subject to moisture. Where the potential for moisture is present, compression type weathertight fittings are required. One hole conduit straps are permitted from 1/2" to 1” and two hole conduit straps are required for size 1 1/4” and larger. EMT shall not be allowed in areas subject to severe physical damage. Install copper ground wire sized per CEC 250-122 in all EMT conduits.

E. Flexible conduit may be used where concealed in building construction or above dropped ceilings, but shall meet the following criteria: No individual circuit path from distribution panel to last device shall exceed a cumulative length of 30’ of flexible conduit from start to end. Flexible conduit shall not exceed a total directional change of 270 bending degrees in any one run between conduit terminations. Squeeze type or Jake type steel flex fittings of a grounding type are required. Flexible conduit must be supported in accordance with CEC. Where exposed to the weather, moisture, or spray down flexible conduit shall be of the liquidtight type. Fittings shall be manufactured for use with liquidtight flexible conduit. All motor connections shall be made with liquidtight flex. Flexible conduit may not be used where exposed except for last 2’ of equipment connection and unless otherwise noted or approved. A copper ground wire sized per CEC 250-122 shall be installed in all flexible conduit runs. Flexible conduit may not be used exposed. Weatherproof liquid tight conduit shall not be used at roof level for equipment connections with lengths exceeding 24” nor shall it be used to circumvent a rigid conduit system in a horizontal direction. Connect recessed lighting fixtures to conduit runs with a maximum of 6’ of flexible metal conduit extending from junction box to fixture. “Master” “Slave” fixtures are permitted to use manufactured flexible cable of longer dimension up to 12’ between “Master” and “Slave” only and only as a U.L. listed system component.

F. Conduit Supports: Conduit runs may be supported by one-hole and two-hole straps or supports as manufactured by Unistrut, Minerallac, Caddy or equals. Supports may be fastened by means of anchors, shields, beam clamps, toggle bolts, or other approved methods appropriate for the application and size of conduit. Pipe nailers (J-hooks) may only be used for 1" conduit and smaller and only in wood frame construction. Conduit support methods are subject to review by the engineer and authority having jurisdiction for adequacy. Installations deemed inadequate shall be corrected by the contractor at no cost to the Owner.

G. Bends and offsets shall be made with approved tools for the type of conduit being utilized. Bends shall be made without kinking or destroying the smooth bore of the conduit. Parallel conduits shall be run straight and true with bends uniform and symmetrical. Minimum radii shall be per CEC 344-24.

H. Marker tape: Place plastic yellow marker tape at 12" below finish grade along and above buried conduits. Label tape "CAUTION: ELECTRICAL LINES BELOW" or similar wording.

I. Electrical and communications systems raceways routed underground shall not occupy the same trench as plumbing utilities such as sewer, water, storm drain, gas or other wet or dry gaseous utility system. A minimum of 12" of undisturbed earth is required. Where utilities must cross in closer proximity to each other due to physical constraints, 6" minimum crossing distances are allowed, however 18" on all sides of a utility crossing must be concrete encased.

J. Conduits, routed below footings, slabs, grade beams, columns, and other structural elements shall be installed in strict compliance with structural details and criteria shown on structural plans. Clearances below structural elements and sleeves through structural elements must be carefully planned to avoid conflict and must be approved by the structural engineer if conflict arises.

K. All conduit or raceways passing through fire rated walls, floors, or ceilings shall be installed with a listed penetration method which protects the opening to the same rating as the assembly and is non hardening.

L. Expansion Joints
1. Conduits 3" and larger, that are secured to the building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.
2. Provide conduits smaller than 3" with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 5" vertical drop midway between the end. All conduit shall have a copper green grounding bonding conductor installed.

M. Seismic Joints
1. At seismic joints, provide conduits rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes or approved fittings, on both sides of the joint. Connect conduits to junction boxes with sufficient slack flexible conduit such that these slack conduits are 1 1/2 times the distance between conduit ends. Flexible conduit shall have a copper green ground bonding jumper installed.

N. Ladder tray shall be used in equipment rooms where shown on the plans. Ladder tray installations shall conform to the requirements of CEC Article 318. The contractor shall

provide all mounting hardware, connectors and bracing as required and as recommended by the manufacturer for a complete system installation.

O. Wire basket tray shall be used in all concealed spaces (above ceiling spaces, under buildings in access tunnels, below raised floors, etc.) unless otherwise noted. Wire basket tray installations shall conform to the requirements of CEC Article 318. The contractor shall provide all mounting hardware, connectors and bracing as required and as recommended by the manufacturer for a complete system installation. All cutting of wire basket tray shall be per the manufacturer's recommendation using tools designed for that purpose. Cable loading shall not exceed the listing of the system and its support.

P. Location: Locate boxes and conduit bodies so as to ensure accessibility of electrical wiring.

Q. Anchoring: Secure boxes rigidly to the substrate upon which they are being mounted, or solidly embed boxes in concrete or masonry.

R. Knockout Closures: Provide knockout closures to cap unused knockout holes where blanks have been removed.

S. Mount outlet boxes, unless otherwise required by ADA, or noted on drawings, the following distances above the finished floor:
1. Receptacles, Telephone, TV & Data outlets. (measured to bottom of outlet box): +15".
2. Outlet above counter (measured to top of outlet box): +46".
3. Control (light) Switches. (measured to top of outlet box): +48".
4. Fire Alarm Manual Pull Stations, T-stats. (measured to top of outlet box): +48".
5. Fire Alarm Visuals: the lower of +80" to bottom of lens, or 6" below ceiling.
6. Other Outlets: As indicated in other sections of specifications or as detailed on drawings.

T. Coordinate all electrical device locations with the architectural floor plan and interior and exterior elevations to prevent mounting devices within elements that they may conflict such as cabinetry, mirrors, planters, etc.

U. Size outlet and junction boxes to minimum wire fill space requirements. Upsize box as required to allow ease of wire installation and device installation.

V. Outlet and junction boxes in fire rated walls shall be gauged and spaced so as not to exceed the maximum penetration allowed by the assembly without compromising the fire rating. If a conflict arises relative to a specific condition, the contractor shall follow the requirements of the fire authority and ask for guidance from the design team. At no time should a larger box be installed prior to resolution of conflict.

END OF SECTION 26 0533

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Section 26 0923
Occupancy Sensors

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Work:
1. Section 26 0500, COMMON WORK RESULTS FOR ELECTRICAL.
2. Section 26 0533, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
3. Section 26 0519, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.
4. Section 26 2726, WIRING DEVICES.
5. Section 26 5670, LIGHTING ACCEPTANCE TESTING.

1.2 SYSTEM DESCRIPTION

A. The occupancy sensors shall sense the presence of human activity within the desired space and enable or disable the on/off manual lighting control function provided by local switches.

B. Upon detection of human activity by the detector, initiate a time delay to maintain the lights on for a preset period of time. Field adjustable time delay setting from 30 seconds to 15 minutes.

C. Sensors shall have factory set PIR sensing sensitivity for maximum sensitivity. Provide time delay at 10 minutes.

D. Install system in accordance with manufacturer's recommendations and instructions.

E. All line voltage sensors, control units, and relays UL listed

1.3 SUBMITTALS

A. Submit in accordance with Section 26 0500, COMMON WORK RESULTS FOR ELECTRICAL.

B. Provide, on reproducible architectural floor plan, a layout of sensors indicating their sensing distribution.

C. Provide wiring diagrams indicating low voltage and line voltage wiring requirements.

PART 2 - PRODUCTS

2.1 PASSIVE INFRARED SENSORS - GENERAL

A. The passive infrared sensors shall detect presence, in the floor area being controlled, by detecting changes in the Infrared energy. Detect small movements, i.e., when a person is writing while seated at a desk.

B. Provide a temperature compensated dual element sensor and a multi element fresnel lens.

C. The sensor shall utilize DIP switch adjustments for "on" mode operation, time delay, and sensitivity.

D. Provide a daylight filter which ensures that the sensor is insensitive to short-wavelength infrared waves, i.e., those emitted by the sun.

E. The sensors not to protrude more than 1 1/2" from the wall or ceiling and should blend in aesthetically.

F. Conceal adjustments and mounting hardware under a removable cover to prevent tampering with adjustments and hardware.

G. Low Voltage Sensors:
1. Sensor shall provide complete coverage of the controlled area.
2. Sensors shall operate on 24VDC power.
3. Sensors shall operate remote power switch packs.
4. Sensors can be wired in parallel to allow coverage of large areas.
5. Manufacturers: The Watt Stopper CI Series, Leviton OSC Series, or approved.

H. Wall Switch Sensors:
1. 300 sq. ft. area coverage, with a field of view of 180 degrees.
2. Completely self-contained sensor system that fits into a standard single gang box. Internal transformer power supply, a latching dry contact relay switching mechanism compatible with electronic ballasts, compact fluorescent, and inductive loads. Triac and other harmonic generating devices are not allowed.
3. Rated to switch loads from 0 to 800 watt incandescent or fluorescent 120 volt and 0 to 1000 watts for 277 volt.
4. Provide adjustable daylight feature that holds lighting "off" when a desired footcandle level is present.
5. Provide integral off override switch with no leakage current to the load or ground.
6. Provide hard 1mm poly IR2 lens, soft lens is not acceptable.
7. Manufacturers: The Watt Stopper PW Series, Leviton ODS Series or approved.
8. Dual Relay: Watt Stopper PW-200, Leviton ODS0D Series, or approved.

2.2 ULTRASONIC OCCUPANCY SENSORS

A. The occupancy sensors capable of detecting presence, in the controlled floor area by detecting Doppler shifts in transmitted ultrasound.

B. Occupancy sensors are precision crystal controlled and shall not interfere with each other when two or more are placed in the same area. Provide ultrasonic circuit with solid state crystal controlled with advanced signal processing.

C. Furnish each sensor with a convenient shunt provision enabling an individual to bypass the sensor in the event of failure. This bypass provision pin or device shall remain in the sensor and be visible from the floor as a constant reminder that the automatic function has been bypassed.

D. Ceiling mounted with maximum protrusion of 1.5" and blend in aesthetically with the ceiling.

E. Provide multi-directional transmitter and ultrasonic receivers that are temperature and humidity resistant.

F. Sensors can be wired in parallel to allow coverage of large areas.

G. Sensitivity adjustment shall range from off at "0" to maximum at "10."

H. Sensors shall operate on 24VDC power.

I. UL listed power pack consisting of a transformer and contact closure relay in one package. Provide a transformer that is capable of operating up to three occupancy sensors.

J. Manufacturers: The Watt Stopper Ultrasonic Series, Leviton OSC Series, or approved.

2.3 DUAL TECHNOLOGY SENSORS

A. Utilize same technologies as passive infrared and ultrasonic.

B. Upon a person entering a space, motion from both technologies must be sensed before lighting will be turned on. After this has occurred, detection by either technology will hold lighting on for the set time period. Sensor shall have a retrigger time delay where only one motion is necessary to turn on the lights within 5 seconds after turning off.

C. Sensors shall have an additional single pole, double throw isolated relay with normally open, normally closed, and common outputs rated at 1 amp for 24VDC and 1/2 amp at 120VAC. The isolated relay is for use with HVAC control, data logging, and other control options.

D. Manufacturers: The Watt Stopper DT Series, Leviton OSC or OSW Series, or approved.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install occupancy sensors as directed by manufacturer's instructions. Complete all electrical connections to all control circuits, occupancy sensors, power supply pack and low voltage wiring.

B. Verify with manufacturer's representative that the sensors are laid out in compliance to manufacturer’s published sensing distribution. Provide additional sensors for complete coverage of the space being sensed.

3.2 QUALITY CONTROL

A. Use manufacturer's published testing and adjusting procedures to adjust sensors time delay, daylight sensitivity, and passive infrared sensitivity to satisfaction of the Owner.

END OF SECTION 26 0923

Section 26 0943
Network Lighting Controls

PART 1 - GENERAL

1.1 SUMMARY

A. The lighting control system specified in this section shall provide time-based, sensor-based (both occupancy and daylight), and manual lighting control.

B. The system shall be capable of turning lighting loads on/off as well as dimming lights (if lighting load is capable of being dimmed)

C. All system devices shall be networked together enabling digital communication and shall be individually addressable.

D. The system architecture shall be capable of enabling stand-alone groups (rooms) of devices to function in some default capacity even if network connectivity to the greater system is lost.

E. The system architecture shall facilitate remote operation via a computer connection.

F. The system shall not require any centrally hardwired switching equipment.

1.2 SUBMITTALS

A. Product Datasheets (general device descriptions, dimensions, wiring details, nomenclature)

B. Riser Diagrams – typical per room type (detailed drawings showing device interconnectivity of devices)

C. Other Diagrams – as needed for special operation or interaction with other system(s)

D. Example Contractor Startup/Commissioning Worksheet – must be completed prior to factory start-up

E. Hardware and Software Operation Manuals

F. Other operational descriptions as needed

1.3 QUALITY ASSURANCE

A. All steps in sensor manufacturing process shall occur in the USA; including population of all electronic components on circuit boards, soldering, programming, wiring, and housing.

B. All components and the manufacturing facility where product was manufactured must be ROHS compliant.

C. In high humidity or cold environments, the sensors shall be conformably coated and rated for condensing humidity and -40 degree Fahrenheit (and Celsius) operation.

D. All applicable products must be UL / CUL Listed or other acceptable national testing organization.

1.4 SUBMITTALS

A. Submit in accordance with Section 26 0500, COMMON WORK RESULTS FOR ELECTRICAL.

1.5 COORDINATION

A. Coordinate lighting control components to form an integrated interconnection of compatible components.

B. Coordinate lighting controls with BAS (if necessary) either through IP based intercommunication of system or hardwired auxiliary relay outputs.

C. The installing contractor shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

1.6 WARRANTY

A. All devices in lighting control system shall have a 5 year warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. This specification is based on the nLight® Network Control System from Sensor Switch, an Acuity Brands Company (800-727-7483, www.sensorswitch.com).

2.2 SYSTEM REQUIREMENTS

A. System shall have an architecture that is based upon three main concepts; 1) intelligent lighting control devices 2) standalone lighting control zones 3) network backbone for remote or time based operation.

B. Intelligent lighting control devices shall consist of one or more basic lighting control components; occupancy sensors, photocell sensors, relays, dimming outputs, manual switch stations, and manual dimming stations. Combining one or more of these components into a single device enclosure should be permissible so as to minimize overall device count of system.

C. System must interface directly with intelligent LED luminaires such that only CAT-5 cabling is required to interconnect luminaires with control components such as sensors and switches.

D. Intelligent lighting control devices shall communicate digitally, require ~3 mA of current to function (Graphic WallPod excluded), and possess at least two RJ-45 connectors.

E. Lighting control zones shall consist of one or more intelligent lighting control components, be capable of stand-alone operation, and be capable of being connected to a higher level network backbone.

F. Devices within a lighting control zone shall be connected with CAT-5 low voltage cabling in any order.

G. Lighting control zone shall be capable of automatically configuring itself for default operation without any start-up labor required.

H. Individual lighting zones must continue to provide a user defined default level of lighting control in the event of a system communication failure with the backbone network or the management software becoming unavailable.

I. Power for devices within a lighting control zone shall come from either resident devices already present for switching (relay device) or dimming purposes, or from the network backbone. Standalone “bus power supplies” shall not be required in all cases.

J. All switching and dimming for a specific lighting zone shall take place within the devices located in the zone itself (i.e. not in a remotely located devices such as panels) to facilitate system robustness and minimize wiring requirements. Specific applications that require centralized or remote switching shall be capable of being accommodated.

K. System shall have one or more primary wall mounted network control “gateway” devices that are capable of accessing and controlling connected system devices and linking into an Ethernet LAN.

L. System shall use “bridge” devices that route communication and distribute power for up to 8 directly connected lighting zones together for purposes of decreasing system wiring requirements.

M. Individual lighting zones shall be capable of being segmented into several channels of occupancy, photocell, and switch functionality for more advanced configurations and sequences of operation.

N. System shall be capable of operating a lighting control zone according to several sequences of operation. System shall be able to change a spaces sequence of operation according to a time schedule so as to enable customized time-of-day, day-of-week utilization of a space. Note operating modes should be utilized only in manners consistent with local energy codes.
   1. Auto-On / Auto-Off (via occupancy sensors):
      a. Zones with occupancy sensors automatically turn lights on when occupant is detected.
      b. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.

c. Pressing a switch will turn lights off. The lights will remain off regardless of occupancy until switch is pressed again, restoring the sensor to Automatic On functionality.

2. Manual-On / Auto-Off (also called Semi-Automatic)
   a. Pushing a switch will turn lights on.
   b. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
3. Manual-On to Auto-On/Auto-Off
   a. Pushing a switch will turn lights on.
   b. After initial lights on, zones with occupancy and/or photocell sensors turn lights on/off according to occupancy/vacancy and/or daylight conditions.
   c. Sequence can be reset via scheduled (ex. daily each morning) events.
4. Auto-to-Override On
   a. Zones with occupancy sensors automatically turn lights on when occupant is detected.
   b. Zone lighting then goes into an override on state for a set amount of time or until the next time event returns the lighting to an auto-off style of control.
   c. Sequence can be reset via scheduled (ex. daily each morning) events
5. Manual-to-Override On
   a. Pushing a switch will turn lights on.
   b. Zone lighting then goes into an override on state for a set amount of time or until the next time event returns the lighting to an auto-off style of control.
   c. Sequence can be reset via scheduled (ex. daily each morning) events
6. Auto On / Predictive Off
   a. Zones with occupancy sensors automatically turn lights on when occupant is detected.
   b. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
   c. If switch is pressed, lights turn off and a short “exit timer” begins. After timer expires, sensor scans the room to detect whether occupant is still present. If no occupancy is detected, zone returns to auto-on. If occupancy is detected, lights must be turned on via the switch.
7. Multi-Level Operation (multiple lighting levels per manual button press)
   a. Operating mode designed specifically for bi-level applications
   b. Enables the user to cycle through the up to four potential on/off lighting states using only a single button.
   c. Eliminates user confusion as to which of two buttons controls which load
   d. Three different transition sequences are available in order to comply with energy codes or user preference)
   e. Mode available as a setting on all nLight devices that have single manual switch (ex. nWSD, nPODM, nPODM-DX).

f. Depending on the sequence selected, every button push steps through relays states according to below table:

Sequence	Altern. Seq		Full On Seq.		3 Step On Seq.	
State #	Relay 1	Relay 2	Relay 1	Relay 2	Relay 1	Relay 2
1	On	Off	On	Off	On	Off
2	Off	On	-	-	Off	On
3	-	-	On	On	On	On
4*	Off	Off	Off	Off	Off	Off

(*step only present for devices without separate off button)

O. Task bar style desktop application shall be available for personal lighting control.

P. An application that runs on "smart" handheld devices (such as an Apple® IPhone®) shall be available for personal lighting control.

Q. Control software shall enable logging of system performance data and presenting useful information in a web-based graphical format and downloadable to .CSV files.

R. Control software shall enable integration with a BMS via BACnet IP.

S. System shall provide the option of having pre-terminated plenum rated CAT-5 cabling supplied with hardware.

2.3 INDIVIDUAL DEVICE SPECIFICATIONS

A. Control Module (Gateway)
1. Module shall be a wall mounted user accessible device that is capable of communicating and controlling downstream system control devices and linking into an Ethernet.
2. Devices shall be powered by low voltage, fit within a two gang switch box (or mounting ring), and have a backlit LCD panel.
3. User control shall be made available via finger-touch buttons with no moving parts. Buttons shall be capable of being locked for security.
4. Device shall have three RJ-45 ports for connection to other backbone devices (bridges) or directly to a lighting control zones devices.
5. Device shall automatically detect all devices downstream of it.
6. Device shall have a standard and astronomical internal time clock.
7. Device shall have one RJ-45 10/100 BaseT Ethernet connection.
8. Each control gateway device shall be capable of linking 400 devices to the management software.
9. Device shall be capable of using a dedicated or DHCP assigned IP address.
10. Network Control Gateway device shall be the following Sensor Switch model number: nGWY.

B. Networked System Occupancy Sensors
1. Occupancy sensors system shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.

2. Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state; thus preventing false on conditions. Ultrasonic or Microwave based sensing technologies shall not be accepted.
3. For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional "dual" technology shall be used.
4. Dual technology sensors shall have one of its two technologies not require motion to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) shall not be acceptable.
5. All sensing technologies shall be acoustically passive meaning they do not transmit sounds waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonics technology. Ultrasonic or Microwave based sensing technologies shall not be accepted.
6. Sensors shall be available with zero, one, or two integrated Class 1 switching relays, and up to one 0-10 VDC dimming output. Sensors shall be capable of switching 120 / 277 / 347 VAC. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @ 347 VAC, and ¼ HP motor. Relays shall be dry contacts.
7. Sensors shall be available with one or two occupancy "poles", each of which provides a programmable time delay.
8. Sensors shall be available in multiple lens options which are customized for specific applications.
9. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
10. All sensors shall have two RJ-45 ports.
11. All sensors shall have the ability to detect when it is not receiving valid communication (via CAT-5 connections) and blink its LED in a pattern to visually indicate of a potential wiring issue
12. Every sensor parameter shall be available and configurable remotely from the software and locally via the device push-button.
13. Sensors shall be able to function together with other sensors in order to provide expanded coverage areas by simply daisy-chain wiring together the units with CAT-5 cabling.
14. Sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements.
15. Wall switch sensors shall recess into single-gang switch box and fit a standard GFI opening.
16. Wall switch sensors must meet NEC grounding requirements by providing a dedicated ground connection and grounding to mounting strap. Line and load wire connections shall be interchangeable. Sensor shall not allow current to pass to the load when sensor is in the unoccupied (Off) condition.
17. Wall switch sensors shall have optional features for photocell/daylight override, vandal resistant lens, and low temperature/high humidity operation.
18. Wall switch sensors shall be available in four standard colors Ivory, White, Light Almond, Gray.
19. Wall switch sensors shall be the following Sensor Switch model numbers, with device color and optional features as specified:

a. nWSD (PIR, 1 Relay)
b. nWSD PDT (Dual Technology, 1 Relay)
c. nWSD 2P (PIR, 2 Relays)
d. nWSD PDT 2P (Dual Technology, 2 Relays)
e. nWSD NL (PIR w/ Night Light, 1 Relay)
f. nWSD PDT NL (Dual Technology w/ Night Light, 1 Relay)
g. nWSD LV (PIR, No Relay)
h. nWSD PDT LV (Dual Technology w/ Night Light, No Relay)

20. Network system shall also have ceiling, fixture, recessed, & corner mounted sensors available.
21. Sensors shall have optional features for photocell/daylight override, dimming control, and low temperature/high humidity operation.
22. Sensors with dimming can control 0 to 10 VDC dimmable ballasts by sinking up to 20 mA of Class 2 current (typically 40 or more ballasts).
23. Sensors shall be the following Sensor Switch model numbers, with device options as specified:

Model # Series	Occup. Poles	# of Relays	Lens Type	Det. Tech.
nCM(B) 9	1	-	Standard	PIR
nCM(B) 9 2P	2	-	Standard	PIR
nCMR(B) 9	1	1	Standard	PIR
nCMR(B) 9 2P	2	2	Standard	PIR
nCM(B) PDT 9	1	-	Standard	Dual
nCM(B) PDT 9 2P	2	-	Standard	Dual
nCMR(B) PDT 9	1	1	Standard	Dual
nCMR(B) PDT 9 2P	2	2	Standard	Dual
nCM(B) 10	1	-	Extended	PIR
nCM(B) 10 2P	2	-	Extended	PIR
nCMR(B) 10	1	1	Extended	PIR
nCMR(B) 10 2P	2	2	Extended	PIR
nCM(B) PDT 10	1	-	Extended	Dual
nCM(B) PDT 10 2P	2	-	Extended	Dual
nCMR(B) PDT 10	1	1	Extended	Dual
nCMR(B) PDT 10 2P	2	2	Extended	Dual
nWV 16	1	-	Wide View	PIR
nWV PDT 16	1	-	Wide View	Dual
nHW13	1	-	Hallway	PIR
nCM(B) 6	1	-	High Bay	PIR
nCMR(B) 6	1	1	High Bay	PIR
nCMR(B) 6 2P	2	2	High Bay	PIR
nCMR(B) 6 480	1	2	High Bay	PIR

Note: Recessed mount versions of the above ceiling (fixture) mount versions also shall be available (e.g. nCMR(B) 9 => nRMR 9)

C. Networked System Daylight (Photocell and or Dimming) Sensors
1. Photocell shall provide for an on/off set-point, and a deadband to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.

2. Photocell and dimming sensor's set-point and deadband shall be automatically calibrated through the sensor's microprocessor by initiating an "Automatic Set-point Programming" procedure. Min and max dim settings as well as set-point may be manually entered.
3. Deadband setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).
4. Dimming sensors shall control 0 to 10 VDC dimmable ballasts by sinking up to 20 mA of class 2 current (typically 40 or more ballasts).
5. Photocell and dimming sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements. (Note: This function should be performed prior to any dimming of the lamps including the "auto set-point" setting.)
6. Combination units that have all features of on/off photocell and dimming sensors shall also be available.
7. A dual zone option shall be available for On/Off Photocell, Automatic Dimming Control Photocell, or Combination units. The second zone shall be capable of being controlled as an "offset" from the primary zone.
8. Line voltage versions of the above described photocell and combination photocell/dimming sensors shall be capable of switching both 120 VAC, 277 VAC, and 347 VAC. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @ 347 VAC, and ¼ HP motor load. Relays shall be dry contacts.
9. Sensor shall be the following Sensor Switch model numbers, with device options as specified:
    a. nCM(B) PC (on/off)
    b. nCM(B) ADC (dimming)
    c. nCM(B) PC ADC (on/off, 0-10 VDC dimming)
    d. nCMR(B) PC (on/off, single relay)
    e. nCMR(B) PC ADC (on/off, 0-10 VDC dimming, single relay)

    Note: Recessed mount versions of the above ceiling (fixture) mount versions also shall be available (e.g. nCMR(B) PC => nRMR PC)

D. Networked System Power (Relay) Packs
1. Power Pack shall incorporate one or more Class 1 relays and contribute low voltage power to the rest of the system. Secondary Packs shall incorporate the relay(s), shall have an optional 2nd relay, 0-10 VDC dimming output, or line voltage dimming output, but shall not be required to contribute system power. Power Supplies shall provide system power only, but are not required to switch line voltage circuit. Auxiliary Relay Packs shall switch low voltage circuits only.
2. Power Packs shall accept 120 or 277 VAC (or optionally 347 VAC), be plenum rated, and provide Class 2 power to the system.
3. All devices shall have two RJ-45 ports.
4. Every Power Pack parameter shall be available and configurable remotely from the software and locally via the device push-button.
5. Power Pack shall securely mount to junction location through a threaded ½ inch chase nipple. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically

meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.

6. When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
7. Power (Secondary) Packs shall be available that provide up to 16 Amp switching of all load types, and be rated for 400,000 cycles.
8. Specific Secondary Packs shall be available that provide up to 5 Amps of switching as well as 0-10 VDC dimming of fluorescent ballasts.
9. Specific Secondary Packs shall be available that provide up to 5 Amps of switching and can dim 120 VAC incandescent lighting loads or 120/277 VAC line voltage dimmable fluorescent ballasts (2-wire and 3-wire versions).
10. Specific Secondary Packs shall be available that provide up to 5 Amps of switching of dual phase (208/240/480 VAC) lighting loads.
11. Specific Secondary Packs shall be available that require a manual switch signal (via a networked Wall Station) in order to close its relay.
12. Specific Secondary Packs shall be available that are UL924 listed for switching of Emergency Power circuits.
13. Power (Relay) Packs and Supplies shall be the following Sensor Switch model numbers:
    a. nPP16 (Power Pack w/ 16A relay)
    b. nSP16 (Secondary Pack w/ 16A relay)
    c. nSP16 SA (Secondary Pack w/ 16A relay, Manual On)
    d. nSP5 2P (Secondary Pack w/ two 5A relays)
    e. nSP5 D (Secondary Pack w/ 5A relay and 0-10VDC dimming output)
    f. nSP5 D ER (UL924 Listed Secondary Pack w/ 5A relay and 0-10VDC dimming output for switching emergency power circuits)
    g. nSP5 PCD 2W (Secondary Pack w/ 5A relay and incandescent dimming or 2-wire line voltage fluorescent dimming output)
    h. nSP5 PCD 3W (Secondary Pack w/ 5A relay and 3-wire line voltage fluorescent dimming output)
    i. nSP5 480 (Secondary Pack w/ 5A relay for switching 208/240/480 VAC loads
    j. nPS 80 (Power Supply)
    k. nAR 40 (Low voltage auxiliary relay pack)

E. Networked Auxiliary Input / Output Devices
1. Devices shall be plenum rated and be inline wired, screw mountable, or have an extended chase nipple for mounting to a ½" knockout.
2. Devices shall have two RJ-45 ports
3. Communication and low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
4. Devices shall have a dimming control output that can control 0 to 10 VDC dimmable ballasts or LED drivers by sinking up to 20 mA of current (typically 40 or more ballasts).
5. Devices shall have an input that read a 0 to 10 VDC signal from an external device.
6. Device shall have a switch input that can interface with either a maintained or momentary switch and run a switch event, or run a local/remote control profile
7. A specific I/O device shall sense state of low voltage outdoor photocells
8. Auxiliary Input/Output Devices shall be the following Sensor Switch model numbers:
    a. nIO (I/O device with dimming or contact closure input and 0-10VDC dimmng output)

b. nIO KO (1/2 knockout mountable, I/O device with dimming or contact closure input and 0-10VDC dimmng output)
c. nIO NLI (Input device for detecting state of low voltage outdoor photocell; sold in nIO PC KIT only)

F. Networked LED Luminaires
1. LED luminaire shall have a mechanically integrated control device.
2. LED luminaire shall have two RJ-45 ports
3. LED luminaire shall be able to digitally network directly to other network control devices (sensors, photocells, switches, dimmers)
4. LED luminaire shall provide low voltage power to other networked control devices
5. System shall be able to turn on/off LED luminaire without using a relay
6. System shall be able to maintain constant lumen output over the specified life of the LED luminarie (also called lumen compensation) by varying the input control power (and thus saving up to 20% power usage).
7. System shall indicate (via a blink warning) when the LED luminaire has reached its expected life (in hrs).
8. LED Luminaires shall be the following Lithonia model families:
   a. RTLED
   b. TLED
   c. VLED
   d. ACLED

G. Networked System Wall Switches & Dimmers
1. Devices shall recess into single-gang switch box and fit a standard GFI opening.
2. Devices shall be available with zero or one integrated Class 1 switching relay.
3. Communication and low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
4. All sensors shall have two RJ-45 ports.
5. All devices shall provide toggle switch control. Dimming control and low temperature/high humidity operation are available options.
6. Devices shall be available in four colors (Ivory, White, Light Almond, Gray).
7. Devices with dimming control outputs can control 0 to 10 VDC dimmable ballasts by sinking up to 20 mA of current (typically 40 or more ballasts).
8. Devices with capacitive touch buttons shall provide audible user feedback with different sounds for on/off, raise/lower, start-up, and communication offline.
9. Devices with mechanical push-buttons shall provide tactile and LED user feedback.
10. Devices with mechanical push-buttons shall be made available with custom button labeling
11. Devices with a single on button shall be capable of selecting all possible lighting combinations for a bi-level lighting zone such that the user confusion as to which of two buttons (as is present in multi-button scenarios) controls which load is eliminated.
12. Wall switches & dimmers shall be the following Sensor Switch model numbers, with device options as specified:
    a. nPOD (single on/off, capacitive touch, audible user feedback)
    b. nPOD 2P (dual on/off, capacitive touch, audible user feedback)
    c. nPODR (single on/off, one relay, capacitive touch, audible user feedback)
    d. nPODM (single on/off, push-buttons, LED user feedback)
    e. nPODM 2P (dual on/off, push-buttons, LED user feedback)

f. nPODM DX (single on/off, single dimming raise/lower, push-buttons, LED user feedback)
g. nPODM 2P DX (dual on/off, dual dimming raise/lower, push-buttons, LED user feedback)
h. nPODM 4P (quad on/off, push-buttons, LED user feedback)
i. nPODM 4P DX (quad on/off, quad dimming raise-lower, push-buttons, LED user feedback)

H. Communication Bridges
1. Device shall surface mount to a standard 4" x 4" square junction box.
2. Device shall have 8 RJ-45 ports.
3. Device shall be capable of aggregating communication from multiple lighting control zones for purposes of minimizing backbone wiring requirements back to Control Gateway.
4. Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply or delivered via a CAT-5 cabled connection.
5. Device shall be careful of redistributing power from its local supply and connect lighting control zones with excess power to lighting control zones with insufficient local power. This architecture also enables loss of power to a particular area to be less impactful on network lighting control system.
6. Communication Bridge devices shall be the following Sensor Switch model numbers:
a. nBRG 8 (8 Ports)

2.4 LIGHTING CONTROL PROFILES

A. Changes to the operation of the system shall be capable of being made in real-time or scheduled via lighting control profiles. These profiles are outlines of settings that direct how a collection of devices function for a defined time period.

B. Lighting control profiles shall be capable of being created and applied to a single device, zone of devices, or customized group of zones.

C. All relays and dimming outputs shall be capable of being scheduled to track or ignore information regarding occupancy, daylight, and local user switches via lighting control profiles.

D. Every device parameter (e.g. sensor time delay and photocell set-point) shall be configurable via a lighting control profile.

E. All lighting control profiles shall be stored on the network control gateway device and on the software's host server.

F. Lighting control profiles shall be capable of being scheduled to run according to the following calendar options: start date/hour/minute, end date/hour/minute, and sunrise/sunset +/- timed offsets.

G. Sunrise/sunset times shall be automatically derived from location information using an astronomical clock.

H. Daylight savings time adjustments shall be capable of being performed automatically, if desired.

I. Lighting control profile schedules shall be capable of being given the following recurrence settings: daily, weekday, weekend, weekly, monthly, and yearly.

J. Software shall provide a graphical tool for easily viewing scheduled lighting control profiles.

2.5 MANAGEMENT SOFTWARE

A. Every device parameter (e.g. sensor time delay and photocell set-point) shall be available and configurable remotely from the software

B. The following status monitoring information shall be made available from the software for all devices for which it is applicable: current occupancy status, current PIR Status, current Microphonics Status, remaining occupancy time delay(s), current photocell reading, current photocell inhibiting state, photocell transitions time remaining, current dim level, device temperature, and device relay state(s).

C. The following device identification information shall be made available from the software: model number, model description, serial number, manufacturing date code, custom label(s), and parent network device.

D. A printable network inventory report shall be available via the software.

E. A printable report detailing all system profiles shall be available via the software.

F. Software shall require all users to login with a User Name and Password.

G. Software shall provide at least three permission levels for users.

H. All sensitive stored information and privileged communication by the software shall be encrypted.

I. All device firmware and system software updates must be available for automatic download and installation via the internet.

J. Software shall be capable of managing systems interconnected via a WAN (wide area network).

2.6 START-UP & SUPPORT FEATURES

A. To facilitate start-up, all devices daisy-chained together (using CAT-5) shall automatically be grouped together into a functional lighting control zone.

B. All lighting control zones shall be able to function according to default settings once adequate power is applied and before any system software is installed.

C. Once software is installed, system shall be able to auto-discover all system devices without requiring any commissioning.

D. All system devices shall be capable of being given user defined names.

E. All devices within the network shall be able to have their firmware reprogrammed remotely and without being physically uninstalled for purposes of upgrading functionality at a later date.

F. All sensor devices shall have the ability to detect improper communication wiring and blink its LED in a specific cadence as to alert installation/startup personnel.

END OF SECTION 26 0943

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Section 26 2726
Wiring Devices

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section Includes:
   1. Wiring devices.

1.3 SUBMITTALS

A. Submit in accordance with Section 26 0500, COMMON WORK RESULTS FOR ELECTRICAL.

B. Related Work:
   1. Section 26 0500, COMMON WORK RESULTS FOR ELECTRICAL.
   2. Section 26 0533, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
   3. Section 26 0519, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.
   4. Section 26 0526, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

PART 2 - PRODUCTS

2.1 RECEPTACLES

A. General: All receptacles shall be listed by Underwriters Laboratories, Inc.
   1. Mounting straps shall be plated steel, with break-off plaster ears and shall include a self-grounding feature (this feature does not substitute for a grounding conductor terminated on grounding strap of device). Terminal screws shall be brass, brass plated or a copper alloy metal.
   2. Receptacles shall be of a screw terminal type, “pressure type quick wire” terminations are not allowed.
   3. 15 ampere and 20 ampere, 125-volt and 250-volt non-locking receptacles shall be tamper resistant type receptacles unless the application is specifically listed as an exception to CEC 406.12.
   4. Receptacles shall be “wet rated” when used in an exterior location.

B. Duplex receptacles shall be commercial grade Style Line/Decora single phase, 20 ampere, 120 volts, 2-pole, 3-wire, and conform to the NEMA 5-20R configuration in NEMA WD 6. The duplex type shall have bussing break-off feature for two-circuit operation. The ungrounded pole of each receptacle shall be provided with a separate terminal.
   1. Wiring device color selection to be provided by Architect. Contractor to verify device color with Architect prior to procurement.
   2. Switched duplex receptacles shall be wired so that only the top receptacle is switched. The remaining receptacle shall be unswitched.
   3. Controlled receptacles; installed per requirements of 2022 BUILDING ENERGY EFFICIENCY STANDARDS / Efficiency Standards, California Code of Regulations, Title 24, Part 6. SECTION 130.5 (d) – ELECTRICAL POWER DISTRIBUTION SYSTEMS as Circuit Controls for 120-Volt Receptacles and / or Controlled Receptacles. Shall be provided with an approved means of including a permanent and durable marking identifying the controlled receptacles or circuits to differentiate them from uncontrolled receptacles or circuits. Where shown on associated floor plans, and or required by the Standards; a duplex noted to be controlled shall be 'split-wire', so the top outlet shall be switched and the bottom outlet shall be unswitched. A double duplex (fourplex) noted to be controlled: one of the duplex receptacles shall be controlled and the other duplex receptacle shall be unswitched.

2.2 SWITCHES AND DIMMERS

A. Style Line/Decora rocker switches shall be totally enclosed tumbler type with bodies of phenolic compound. Toggle handles color to match receptacle device color unless otherwise specified.
   1. Shall be single unit toggle, butt contact, quiet AC type, heavy-duty general-purpose use with an integral self grounding mounting strap with break-off plasters ears and be of a screw terminal type.
   2. Shall be color coded for current rating, listed by Underwriters Laboratories, Inc., and meet the requirements of NEMA WD 1, Heavy-Duty and UL 20.
   3. Ratings:
      a. 120 volt circuits: 20 amperes at 120-277 volts AC.
      b. 277 volt circuits: 20 amperes at 277 volts AC.
   4. The switches shall be mounted on the strike plate side of doors.
   5. Incorporate barriers between switches with multi-gang outlet boxes where required by the CEC.
   6. All toggle switches shall be of the same manufacturer.

2.3 WALL PLATES

A. Wall plates for switches and receptacles shall be thermo plastic.

B. Standard NEMA design, so that products of different manufacturers will be interchangeable. Dimensions for openings in wall plates shall be accordance with NEMA WD1.

C. For receptacles or switches ganged together, wall plates shall be a single ganged plate.

D. Wall plates for data, telephone or other communication outlets shall be as specified in the associated specification.

E. Surface mounted boxes, NEMA1, shall be industrial grade raised galvanized steel covers. In shop areas all receptacles shall be dust proof and or waterproof where applicable.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Switches installed in hazardous areas shall be explosion proof type in accordance with the CEC and as shown on the drawings.

B. Installation shall be in accordance with the CEC, NECA "Standard of Installation", and as shown as on the drawings.

C. Ground terminal of each receptacle shall be bonded to the outlet box with an approved green bonding jumper, and also be connected to the green equipment grounding conductor.

D. General: Devices shall be of the type specified herein. All devices shall be installed with "pigtailed" leads from the outlet box. No device shall be used in the "feed through" application. Screw terminals shall be used to connect all devices to the circuit and shall be grounded by means of a ground wire where grounding terminals are provided in the device.

E. Installation: Devices and plates shall be installed in a "plumb" condition and must be flush with the finish surface of the wall where boxes are recessed.

F. Mounting heights: All control and convenience devices shall comply with California Code of Regulations Title 24 and ADA with respect to accessibility requirements. Mounting heights indicated on plans shall have precedence.

G. Install switches with the off position down.

H. Clean debris from outlet boxes.

I. Provide extension rings as required to bring outlet boxes flush with finished surface or casework.

J. Test each receptacle device for proper polarity.

END OF SECTION 26 2726

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Section 26 5100
Interior Lighting

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section Includes:
1. Interior lighting systems, including luminaires, ballasts, lamps and emergency lighting equipment.

B. Related Work:
1. Section 26 0500, COMMON WORK RESULTS FOR ELECTRICAL.
2. Section 26 0533, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS: Conduits, fittings, and boxes for raceway systems.
3. Section 26 0519, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low voltage power and lighting wiring.
4. Section 26 0526, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
5. Section 26 5600, EXTERIOR LIGHTING.
6. Section 26 5670, LIGHTING ACCEPTANCE TESTING.

1.3 SUBMITTALS

A. Submit in accordance with Section 26 0500, COMMON WORK RESULTS FOR ELECTRICAL.

B. Shop Drawings:
1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
2. Include electrical ratings, dimensions, mounting, details, materials, terminations, wiring and connection diagrams, photometric data, ballasts, luminaires, lamps and controls.

1.4 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

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

C. American National Standards Institute (ANSI).

D. Aluminum Association Inc. (AA).

E. Illuminating Engineering Society of North America (IESNA).

F. National Electrical Manufacturers Association (NEMA).

G. National Fire Protection Association (NFPA).

H. Underwriters Laboratories, Inc. (UL).

1.5 DEFINITIONS

A. Lighting terminology used herein is defined in IES

B. Exception: The term "driver" is used herein to cover both drivers and power supplies, where applicable.

C. Clarification: The term "LED light source(s)" is used herein per IES to cover LED package(s), module(s), and array(s).

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment shall be in accordance with CEC, UL, ANSI, and as shown on the drawings and specified.

2.2 LIGHTING FIXTURES (LUMINAIRES)

A. Shall be in accordance with NFPA 70, UL 1598 and shall be as shown on drawings and as specified. All luminaires shall have been certified to the California Energy Commission by its manufacturer to comply with the efficiency standards as per California Code of Regulations Title 24, Part 6, Section 111 referencing the Appliance Efficiency Regulations in Title 20. Post certification with building permit.

B. Sheet Metal:
1. Shall be formed to prevent warping and sagging. Housing, trim and lens frame shall be true, straight (unless intentionally curved) and parallel to each other as designed.
2. Wireways and fittings shall be free of burrs and sharp edges and shall accommodate internal and branch circuit wiring without damage to the wiring.
3. When installed, any exposed fixture housing surface, trim frame, door frame and lens frame shall be free of light leaks; lens doors shall close in a light tight manner.

a. Hinged door closure frames shall operate smoothly without binding when the fixture is in the installed position, and latches shall function easily by finger action without the use of tools.

C. Recessed fixtures shall be of the type approved for the ceiling and insulation conditions and appropriate for the installation location. Insulation must be held back from the fixture to provide manufacturers' recommended clearances for proper operation. Thermal tripping shall be the installer's responsibility to correct. Where installed in fire rated ceilings, coordinate installation of fire rated enclosures around the ceiling penetrations. Fixtures shall contain the proper through wiring capacity for that which is shown on the plans.

D. Recessed fixtures shall be provided with the appropriate trims and hardware compatible with the ceiling type shown. Plaster frames are required where plaster or gypsum board ceilings are encountered.

E. Mechanical Safety: Lighting fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by captive screws, chains, captive hinges or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.

F. Metal Finishes:
1. The manufacturer shall apply standard finish (unless otherwise specified) over a corrosion resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Edges of pre-finished sheet metal exposed during forming, stamping or shearing processes shall be finished in a similar corrosion resistant manner to match the adjacent surface(s). Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking.
2. Interior light reflecting finishes shall be white with not less than 85 percent reflectances, except where otherwise specified on the drawing.
3. Exterior finishes shall be as shown on the drawings.

G. Provide all lighting fixtures with a specific means for grounding metallic wireways and housings to an equipment grounding conductor.

H. Recessed compact fluorescent or LED fixtures shall be manufactured specifically for compact fluorescent or LED lamps with ballasts or drivers integral to the fixture. Assemblies designed to retrofit fixtures are prohibited except when described in this fashion. Fixtures shall be designed for lamps as specified.

I. Provide wire lamp guard on all exposed lamp fixture/luminaires.

J. Provide fixtures with a U.L. listing for shower or shower rating above shower or tub areas.

2.3 LED LUMINAIRE REQUIREMENTS

A. General Requirements:
1. Luminaire shall have an external label per ANSI C136.15
2. Luminaire shall have an internal label per ANSI C136.22.
3. Luminaires shall start and operate in -20°C to +40°C ambient.
4. LED light source(s) and driver(s) shall be RoHS compliant.

2.4 LED DRIVER

A. Driver
1. Rated case temperature shall be suitable for operation in the luminaire operating in the ambient temperatures as indicated.
2. Shall accept the voltage or voltage range indicated, and shall operate normally for input voltage fluctuations of plus or minus 10 percent. Consistent with NEMA SSL 1.
3. Shall have a minimum Power Factor (PF) of 0.90 at full input power and across specified voltage range.

B. Electromagnetic interference
1. Shall have a maximum Total Harmonic Distortion (THD) of 20% at full input power and across specified voltage range.
2. Shall comply with FCC 47 CFR part 15 non-consumer RFI/EMI standards.

C. The following shall be in accordance with corresponding sections of ANSI C136.37
1. Wiring and grounding
2. All internal components shall be assembled and pre-wired using modular electrical connections.
3. Mounting provisions
4. Terminal blocks for incoming AC lines
5. Latching and hinging
6. Ingress protection

2.5 LAMPS

A. Provide lamps for all luminaires.

B. LED LIGHT SOURCE
1. Minimum Color Rendering Index (CRI): 60.
2. Correlated Color Temperature (CCT)
a. CCT shall be as listed in Table 1 below:

Table 1. Allowable CCT

Manufacturer-Rated Nominal CCT (K)	Allowable LM-79 Chromaticity Values Measured CCT (K)
2700	2580 to 2870
3000	2870 to 3220
3500	3220 to 3710
4000	3710 to 4260
4500	4260 to 4746
5000	4745 to 5311
5700	5310 to 6020
6500	6020 to 7040

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation and furnishing of lighting fixtures shall be in accordance with the CEC, manufacturer's instructions and as shown on the drawings or specified. Fixtures damaged in transit and storage prior to completion shall be replaced at Contractor's expense.

B. Align, mount and level the lighting fixtures uniformly.

C. Avoid interference with and provide clearance for equipment. Where the indicated locations for the lighting fixtures conflict with the locations for equipment, change the locations for the lighting fixtures by the minimum distances necessary as approved by the Architect. The Architectural reflected ceiling plan will take precedence over electrical plans.

D. For suspended lighting fixtures, the mounting heights shall provide the clearances between the bottoms of the fixtures and the finished floors as shown on the drawings.

E. Lighting Fixture Supports:
1. Contractor shall provide support for all of the fixtures independent of suspended ceilings. Supports may be anchored to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.
2. Shall maintain the fixture positions after cleaning and relamping.
3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.
4. Hardware for recessed fluorescent fixtures:
5. Fixtures shall be supported as detailed on drawings and as required by DSA standards.
6. Installation: Fixtures shall be securely mounted on ceilings and walls with appropriate fastening devices. "Drop-in" type T-bar fixtures shall be secured with #12 gauge safety "earthquake wires" as described by California Code of Regulations Title 24 Part 2, Chapter 47. "Earthquake clips" will be required for fastening to the T-bar system in addition to safety wire. Surface mounted fluorescent fixtures shall be solidly screwed or clipped into framing above drywall with 4-#10 sheet metal screws into each fixture. Provide blocking for screw supports behind all surface mounted lighting fixtures weighing more than 15 lbs.
7. Surface mounted lighting fixtures:
   a. Fixtures shall be bolted against the ceiling independent of the outlet box at four points spaced near the corners of each unit. The bolts shall be minimum ¼-20 bolt, secured to structural ceiling. Non-turning studs may be attached to the building structure by 12 gauge safety hangers.
8. Fixtures mounted in open construction shall be secured directly to the building structure with approved bolting and clamping devices.
9. Single or double pendent mounted lighting fixtures:
   a. Each stem shall be supported by an approved outlet box, mounted swivel joint and canopy which holds the stem captive and provides spring load (or approved equivalent) dampening of fixture oscillations. Outlet box shall be supported vertically from the building structure and be allowed to swing to a 45 degree angle.
10. Outlet boxes for support of lighting fixtures (where permitted) shall be secured directly to the building structure with approved devices or supported vertically in a hung ceiling from the building structure with a nine gauge wire hanger, and be secured by an approved

device to a main ceiling runner or cross runner to prevent any horizontal movement relative to the ceiling.

F. Furnish and install the specified lamps for all lighting fixtures as part of this project.

G. Coordinate between the electrical and ceiling trades to ascertain that approved lighting fixtures are furnished in the proper sizes and installed with the proper devices (hangers, clips, trim frames, flanges), to match the ceiling system being installed.

H. Bond lighting fixtures and metal accessories to the grounding system as specified in Section 26 0526, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

I. At completion of project, relamp all fixtures which have failed/burned-out lamps. Clean all fixtures, lenses, diffusers and louvers that have accumulated dust/dirt during construction.

J. Provide unswitched leg of interior lighting branch circuit to integral emergency battery pack light fixtures, exit signs and night lights as applicable per lighting plans.

K. Wallmount fixtures in walkway areas shall not project more than 4 inches from wall when projection occurs lower than 80 inches.

END OF SECTION 26 5100

Section 26 44567000
Lighting Acceptance Testing

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section Includes:
   1. The Contractor shall be responsible for the Certificate of Acceptance, but coordinate with the Certified California Lighting Controls Test Technician to assure that all required documents have been filed with and approved by the enforcement agency prior to receiving a final occupancy permit. The Certificate of Acceptance will indicate that the Contractor has demonstrated acceptance requirements of the plans and specifications, that current requirements for installation certificates are met, and that currently required operating and maintenance information (as well as the Certificate of Acceptance) were provided to the building Owner.
   2. Testing, evaluation and calibration of lighting controls equipment provided, installed and connected in Division 26.
   3. Documentation of test results, completion of "Certificate of Acceptance" and "Certificate of Installation" forms and filing with the enforcement agency for approval.
   4. Specific Jobsite Conditions:
      a. Acceptance testing must be tailored for each specific design, job site, and climactic conditions. While the steps for conducting each test remain consistent, the application of the tests to a particular site may vary. The Contractor shall review the construction documents and include all required time, material, testing equipment, etc. as required to complete the requirements of this section.

B. Related Work:
   1. Section 26 0500, COMMON WORK RESULTS FOR ELECTRICAL.
   2. Section 26 5100, INTERIOR LIGHTING.
   3. Section 26 5600, EXTERIOR LIGHTING.
   4. Section 26 0926, LIGHTING CONTROL SYSTEM.
   5. Section 26 0900, CONTROLS AND INSTRUMENTATION.
   6. Section 26 0923, OCCUPANCY SENSORS.

1.3 REFERENCES

A. Acceptance Testing Criteria: 2022 Building Energy Efficiency Standards Non-Residential Compliance Manual.

1.4 SYSTEM DESCRIPTION

A. Performance Requirements:
1. All material, equipment, labor and technical supervision to perform tests, calibrations and documentation specified herein.

B. Scope of Testing, Evaluation and Calibration (as applicable):
1. Automatic (master) time switches.
2. Occupancy sensors.
3. Automatic daylighting controls.
4. Photo electric sensors.
5. Daylighting controls.
6. Outdoor astronomical time switches.
7. Area controls.

1.5 SUBMITTALS

A. Submit in accordance with Section 26 0500, COMMON WORK RESULTS FOR ELECTRICAL.

B. Test Reports:
1. Written record of all tests and completion of forms included in this section.
2. At completion of project, assemble a final test report. Submit report to the enforcement agency and the Owner prior to final occupancy to include:
   a. Summary of project.
   b. Description of systems and equipment tested.
   c. Visual inspection report.
   d. Description of tests.
   e. Test results.
   f. Conclusions and recommendations.
3. Report shall be bound in booklet form, include on the Contractor's letterhead the title of the report and the systems tested.

C. Constructability Plan Review
1. The Contractor shall review the construction drawings and specifications to understand the scope of the acceptance tests and raise critical issues that might affect the success of the acceptance tests prior to starting construction. Any constructability issues associated with the lighting system should be forwarded to the design team for review/modifications prior to equipment procurement and installation. The Contractor shall submit on company letterhead, with the lighting control equipment required by Section 26 0500, COMMON WORK RESULTS FOR ELECTRICAL, 1.4B, a letter confirming that the constructability review has been completed and their company has reviewed and is prepared to complete the lighting acceptance testing required by this section.

PART 2 - PRODUCTS

2.1 FORMS

A. Lighting Installation forms and verification procedures for lighting systems that require acceptance testing can be downloaded from the following website: www.energy.ca.gov/2015publications/CEC-400-2015-033/appendices/forms/NRCI

B. Lighting Acceptance forms are to be provided by a Certified California Lighting Controls Acceptance Test Technician. The California Energy Commission adopted changes to the California building Efficiency Standards (Title 24, Parts 1 and 6) that require lighting controls and devices to be certified as properly installed and operational, prior to issuance of occupancy permits. All Acceptance Technicians must be employed by an Acceptance Test employer that provides support as well as quality control. Certified California Lighting Controls Acceptance Test Technicians can be found at the following website: www.calctp.org/acceptance-technicians/contractors

C. These completed forms will be the deliverable product to the enforcement agency and Owner as described in 1.4 of this section.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Tests:
1. Contractor's Responsibilities:
   a. Perform all required tests required by this section.
   b. Schedule testing with building Owner.
   c. Provide Installation forms
   d. Acceptance forms provided by California Certified Lighting Controls Technician hired by Contractor.
   e. Calibration of equipment such as light meters, photo electric controls, etc.
   f. Programming of time switches (interior/exterior lighting) for operations as directed by the Owner.

3.2 ADJUSTING

A. Final Settings: The Contractor shall be responsible for implementing all final settings and adjustments on controls equipment as required for a complete and operating system.

END OF SECTION 26 5670

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Section 28 3100
Fire Alarm and Detection Systems

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section Includes:
1. Provide a complete campus wide, fully addressable, power limited, fire detection and evacuation system. The system shall be connected, tested, verified by AHJ to be acceptable and left in first class operating condition. All equipment herein specified shall be engineer-approved and California State Fire Marshal (CSFM) listed. The entire installation shall conform to the National Fire Protection Association (NFPA) Standard 72, 90A & CEC Article 760 and authorities having jurisdiction as applicable. The system specified and depicted on the plan is a complete and approved system. Substitution of system components or manufacturer will require the contractor to separately obtain approval with the CSFM at Contractor's expense and shall meet all requirements of the system as designed and pre-approved. The entire fire alarm system has been submitted and approved by the Division of the State Architect as a complete submittal. Any routing of the system wiring that is significantly different than shown on the approved drawings shall have the approval of the engineer and must be obtained prior to construction.
2. Provide all work and material as shown and / or required to provide a fully functional and adequate system as described hereon and as required by the California State Fire Marshal.
3. Supervision: The fire alarm system shall monitor the integrity of all alarm initiating and indicating appliance circuits and provide local and remote status of all connected systems. The system shall be provided with automatically charged standby batteries to maintain system operation for 24 HRS in the normal supervisory mode and 5 minutes of alarm. Batteries shall be supervised for connection to the system and low voltage threshold. The automatic battery charger shall be capable of charging fully discharged system batteries to 100% in 8 hours.
4. The system wiring and installation shall be as stated in drawings and as required by the manufacturer. All wiring shall be color coded, tagged and verified to assure that it is free from shorts and grounds and shall be rated for the appropriate environmental conditions such as well locations.
5. Testing: The completed system shall be tested in accordance with NFPA Standard 72-7-1.
6. Warranty: The equipment and wiring shall be warranted to be free from electrical and mechanical defects for a period of two (2) years commencing with final acceptance by Owner.
7. All Fire Alarm wiring shown in drawings shall be installed in conduit.
8. System Operation shall include:

a. Separate zone signaling and device status indication for all initiating devices.
b. Audible to sound the California uniform fire alarm signal in temporal mode. Devices shall be at least 15dBA above average ambient sound level, but not less than 75dBA at 10' or more than 120dBA.
c. Visual devices shall not exceed 2 flashes per second and shall not be slower than 1 flash per second. Visual devices shall be synchronized when 3 or more devices are within the same field of view.
d. Supervision of all circuits to indicate any abnormal wiring condition.
e. One (1) N.O./N.C. integral relay for external device interface or as indicated on drawings.
f. Central station connection capable of indicating (3) distinct separate signals as being tamper, trouble and alarm with point reporting capabilities.

9. All work shall be completed as shown on the plans and or as specified within this specification and shall include the following (but is not limited to):
   a. Life safety fire alarm detection and signaling system.
   b. Furnishing and installation of equipment and devices.
   c. Conductors, connections and interconnections where specified and all in conduit system.
   d. Interface with elevator controls.
   e. Conduit, wire and connections for control of heating and ventilation motors, smoke dampers and smoke exhaust.
   f. Testing, cleaning and adjusting of completed work.
   g. Wiring diagrams, as-built drawings and three (3) sets of equipment operations and maintenance instructions for Owner.
   h. Complete maintenance for two years. Proposal for subsequent maintenance contract.
   i. All work and material for complete and operable systems as indicated or specified.
   j. Permits, inspections and fees.
   k. Identification and instruction to Owner Representative. Training shall consist of a minimum or two (2) 6-hour sessions.
10. Coordination with Section 26 0533, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
11. Furnishing of special back boxes where required for installation of fire alarm devices.
12. Mechanical system duct detectors shall interface with fire alarm system without additional or special control devices.
13. All conductors to be installed in conduit pursuant to Specification Section 26 0533, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
14. Qualifications: Contractor shall receive written approval and verified test results which shall be submitted to the owner for system from manufacturers recognized representative prior to completion and acceptance.
15. All initiating devices shall be separately addressed for individual identification at control panel.
16. As-Built Drawings: A complete set of reproducible "as-built" drawings showing installed wiring, color coding, wire tag notations exact locations of all installed equipment, specific interconnections between all equipment and internal wiring of the equipment shall be delivered to the owner upon completion of the system.
17. Maintenance Instructions: Three (3) submittals of maintenance instructions shall be provided and shall be complete, easy to read, understandable and shall provide the following information:

a. Instructions for replacing any components of the system, including internal parts.
b. Instructions for periodic cleaning and adjustments of equipment with a schedule of these functions.
c. A complete list of all equipment and components with information as to the address and telephone number of both the manufacturer and local supplier of each item.
d. User operating instructions shall be prominently displayed on a separate sheet located next to the control unit in accordance with UL Standard 864. The contractor shall warrant all equipment and wiring free from inherent mechanical and electrical defects for two years from the date of final acceptance.

1.3 SUBMITTALS

A. Submit in accordance with Section 26 0500, COMMON WORK RESULTS FOR ELECTRICAL.

B. The submittal shall include certification from the manufacturer verifying that the distributor is an authorized agent, who is qualified and trained by the manufacturer in the proper installation, operation and service of the system.

C. Shop Drawings:
1. A complete list of all supplied equipment including model numbers with catalog data sheets on each component and CSFM number.
2. Provide schematic layout, floor plan, drawings indicating location of all components and equipment, required size and location of conduit and outlets and type and quantity of system conductors. Include voltage drop calculations and battery calculations based on actual number of devices to be installed.
3. Include wiring diagrams for overall system and components including control panels, annunciators, power supplies, initiating circuits, notification appliances, control devices and FATC. Address numbers shall be noted on all appliances.
4. Include physical and electrical characteristics of equipment to indicate conformance with the Specifications.
5. Describe system characteristics and function as well as device wiring diagrams.
6. Voltage drop and battery calculations for each control panel and power supply and initiating circuits.
7. System operational matrix.

D. Data Sheets: Show California State Fire Marshal Listing, U.L. listing, equipment ratings, dimensions and finishes.

E. Manufacturer's Certificate: Note whether the system meets or exceeds specified requirements.

F. Operating and Maintenance Instruction Manual:
1. Manual shall include the following tailored to this specific project:
a. Operational description.
b. Coded cabling plan.
c. Two wire circuit diagrams.
d. Wiring destination schedule.
e. Schematic component diagrams and PC board layouts.

f. Maintenance and alignment procedures.
g. Voltage drop and battery calculations.

1.4 COORDINATION

A. Refer to the electrical and mechanical drawings and specifications to determine quantities and location of devices and required scope of work and coordinate work with mechanical and electrical installers. Provide function described under mechanical section Sequence of Control, for fire and/or emergency conditions. Submit proposed interconnection to elevator supplier. Submit conduit and pathing requirements to electrical installer. For self-contained door release, coordinate with door supplier.

1.5 SYSTEM DESCRIPTION

A. General: System to be listed by Underwriters Laboratories and the California State Fire Marshal, designed to meet the functional requirements of NFPA 72A, 72B and 72D.

B. Features:
1. Main fire control command center panel with graphic annunciator, printer (where specified) and alarm communicator transmitter (DACT) where specified and/or required.
2. Remote annunciator(s) as specified.
3. Alarm/trouble point transmitters.
4. Manual alarm reporting stations (addressable).
5. Ionization smoke detectors (addressable).
6. Fan duct smoke detectors (addressable).
7. NAC extender panels.
8. Combination speaker/visual alarm signal devices.
9. Horn and audible devices.
10. Visual alarm signal device.
11. Exterior bell.

1.6 SYSTEM OPERATION

A. System to be the active interrogate/respond type alarm system, 24 volt DC noncoded, positive, non-interfering, successive operation, in which all devices are constantly sending status signals to the main fire control command center from remote data transmitter panels approximately every one second. A change in status to be reported twice to determine that it is a valid signal, and be automatically and permanently recorded.

B. Wiring, equipment and devices for alarm initiation, annunciation, and audible signaling to be continuously supervised for opens, shorts or grounds (trouble). Each alarm initiating device circuit to be provided with illuminated and audible annunciation of both trouble and alarm conditions. Non-illumination indicates a normal condition.

C. Any alarm or trouble condition shall sound an audible signal at the fire command center and the remote annunciator. Signal shall be silenced by a momentary contact switch which shall transfer the signal to a visual indicator. Subsequent trouble conditions shall cause the signal to

resound and in turn may be silenced. Upon restoration to normal, the trouble signal silencing indicator shall extinguish automatically.

D. Activation of any automatic or manual alarm initiating device shall cause the following to occur:
   1. Sound an audible alarm and illuminate the visual indicator for zone and type of alarm at the fire command center, the remote annunciator and fire alarm control panel.
   2. Sound, at building of origin, the audible alarm signal over the system audible devices and activate the visual signal devices.
   3. Transmit signal to release the electromagnetic hold open devices on corridor doors by floor.
   4. Transmit signal to close smoke dampers.
   5. Transmit alarm signal to energy management system for shutdown of building air handler.
   6. Transmit alarm signal to the central station office.
   7. Release exit door locks.

E. System shall not incorporate a time delay for any of the alarm initiating devices. All alarms shall be considered confirmed alarms.

F. Detection shall be addressable and reporting of fire conditions to be accomplished by the following basic methods:
   1. Manual stations.
   2. Smoke detectors.

G. Fire alarm system inputs to be further subdivided as follows, for a more defined indication of the location and nature of the fire or trouble condition:
   1. Manual station by device and location.
   2. Smoke/heat detector by device and location.
   3. Waterflow or pressure switch by device and location.
   4. Sprinkler valve position indication by device and location.

H. Alarm condition shall override trouble indication. Trouble indication shall reappear after alarm reset.

I. Fire Alarm Zones shall be as indicated on drawings.

J. Printout on system printer of all alarm and trouble reports, indicating type of device, condition, time and date and alarm clearing.

K. Selective manual testing of any device point or zone in the system to determine normal, trouble or alarm status.

L. Command center shall have annunciator indicating building floor, room number and zone.

M. Remote annunciators to duplicate annunciation from the main fire control command center.

N. System shall be capable of manual operation in the event of malfunction of the central processor. Supplier shall include a statement in the system shop drawing submittal explaining

the manual operating capability of the system. System shall provide redundant processor capabilities to duplicate primary processor function.

O. Operation: All components shall be interconnected in accordance with the manufacturer's instructions to provide a complete and operable system as described.

1.7 FIRE ALARM SYSTEM FUNCTIONALITY

A. Provide a complete, electrically supervised networked addressable fire alarm and control system, with analog initiating devices.

B. The system shall be a multiprocessor based control panels model FCI-7200A, or approved equal communicating over a peer-to-peer token ring network over fiber with a capacity of up to 64 nodes.

C. Each node shall incorporate a fire alarm control panel with associated intergrading and signaling circuits.

D. The control panels shall have the capability to accept firmware upgrades via laptop computer, without the requirement of replacing hardware components.

E. The network shall be based on a peer-to-peer token ring technology operating at 625 K baud, using Style 4, 6 or 7.

F. The network shall include the capability of using fiber-optic cables up to 200 microns.

G. Each network node shall be capable of being programmed off-line using Windows based software supplied by manufacturer. Each node shall also be capable of being downloaded by connecting a laptop computer into any node in the system.

H. Each network node shall be capable of being grouped with any number of additional nodes to produce a “Region”, allowing that group of nodes to act as one, while retaining the peer-to-peer functionality.

I. Each network node shall be capable of annunciating all events within its “Region” or annunciating all events from the entire network, on the front panel LCD without any additional equipment.

J. Each network node shall be capable of having an integral digital alarm communication transmitter (DACT) that can report events in either its region, or the entire network to a single account.

K. Each fire alarm control panel shall be capable of storing its entire program, and allow the installer to activate only the devices that are installed during construction, without further downloading of the system.

L. Each system shall be provided with four (4) levels of password protection with up to sixteen (16) passwords.

M. Each node shall be capable of using up to 125 "Network Groups" to allow control between different nodes.

1.8 LOADS OF EQUIPMENT AND COMPONENTS

A. Follow IEEE Standard where applicable.

B. Provide fuse protection for equipment and spare fuses.

C. Design systems for operation at 120 volts, normal or emergency power as indicated, 60 Hz nominal input.

D. Operating voltage dissipated by resistors shall not exceed 25% of ratings.

E. Operating voltage of capacitors shall not exceed 80% of rated voltage.

F. Operating loads and voltages on transistors and solid-state devices shall not exceed manufacturer's recommendation for normal full load operation.

G. Use electronic components of types and rating commonly available from stock of established commercial distribution.

1.9 GUARANTEE

A. Conform to applicable provisions of the GENERAL REQUIREMENTS.

B. Service technicians and replacement components for the system shall be available locally from a service representative of the manufacturer who is able to provide evidence of technical training and authorization by the manufacturer.

C. For a period of two years from date of final acceptance, the system shall be under full guarantee for materials and labor at no cost to the Owner. The system shall be under a service contract with a technician authorized by the manufacturer. Replacement parts and labor shall be readily available during normal business hours while the service contract is in effect. A complete system inspection and test shall be performed at five months and again at eleven months after final acceptance. Tests shall include all smoke detector sensitivity settings.

D. All component failures shall be remedied to the satisfaction of the Owner.

E. A continuing service contract shall be offered at time of bid to commence at the expiration of warranty included with the system.

PART 2 - PRODUCT

2.1 MATERIALS

A. Fire Alarm Control Panel (FACP) and system shall be UL listed for power-limited application, (as described on the plans). System shall be as manufactured by Fire Control Instruments (FCI) or approved alternate.

B. Peripheral Devices
   1. Analog Photoelectric Smoke Sensors (refer to drawings for model number).
      a. Analog photoelectric sensors shall have a low profile and be capable of being set at five sensitivity settings of "LOW, LOW MEDIUM, MEDIUM, MEDIUM HIGH, and HIGH" levels.
      b. Automatic and manual functional sensitivity and performance tests shall be possible without the need for generating smoke. This method shall test all sensor circuitry and a "Failed Test" indication shall display for any failed test.
      c. Two LEDs providing 360-degree visibility of operating status and alarm indication shall be provided on each sensor. The LEDs shall pulse periodically indicating that the sensor is receiving power and communication is taking place. This feature shall be field programmable. Upon alarm, these LEDs shall light continuously. An alarm output shall be available for remote annunciation.
      d. The system shall check the sensitivity of each sensor periodically. If a sensor alarm threshold sensitivity has changed, due to again and/or dust accumulation, the system shall automatically compensate for this change (drift compensation).
      e. Each sensor shall allow for the setting of two sensitivity levels. These levels may be programmed so that when the building is occupied, a sensor will be less sensitive than when the building is unoccupied. This feature permits sensors to be more reliable and at the same time reduces/minimizes unwanted alarms. This feature shall also provide for programmable weekend days, where the sensor will remain at an unoccupied sensitivity level.
      f. The sensor screen and cover assembly shall be removable for field cleaning.
   2. Manual Fire Alarm Station: Double Action Manual Station (refer to drawings for model number):
      a. Furnish and install a manual station as indicated. Each station shall be of the addressable double action type, requiring an outer door to be lifted to expose the actuator door. Upon pulling forward of the actuator door, the unit shall lock into a readily observable "alarm" position.

C. Fire Alarm remote power supply, NAC panel, shall be UL listed for power-limited application. Provided with (4) four-signal circuits minimum capacity or as required to make system fully operational with an output current of 6 to 9 amps as required for proper operation.

D. System Devices and components shall be provided as specified on the fire alarm equipment legend and as shown on associated electrical drawing:

E. Fire Alarm terminal cabinet shall be Square D Class 6650. Size as shown on drawings or as required.

F. Substitutions

1. The fire alarm System has been designed and approved as a “complete system”. Substitute equipment will be approved when the following conditions are met:
   a. A request for substitution shall be made prior to bid for the Owner’s and design team consideration and approval.
   b. Submit detailed fire alarm plans, specifications and engineering calculations including but not necessarily limited to:
      1) CSFM listing #’s and Manufacturer Model #’s for every system component which is to be interconnected as a part of this project.
2. Single line, riser and point to point wiring diagrams including battery and voltage drop calculations for the entire system in compliance with NFPA 72. Indicating appliance shall be calculated on the bases of the highest current rating possible at that device.
3. Indication of conductor type(s), power-limited or non-power-limited system, independent of interconnected to existing system.
4. Submit / obtain approval from the Owner for the entire system.
   a. The party requesting the substitution shall be responsible for any additional cost acquired during the approval.

PART 3 - EXECUTION

3.1 GENERAL

A. Comply with all applicable paragraphs in Section 260500, COMMON WORK RESULTS FOR ELECTRICAL, apply as though repeated herein.

B. Install system(s) in accordance with manufacturer's instructions.

C. Include services of certified technicians to supervise installation, provide adjustments, provide final connections, system testing and system training to Owner Representative.

3.2 GROUNDING

A. All equipment to be grounded by means of green ground wire to "U" contact of duplex receptacles and bonded to ground provided under 26 0526, GROUNDING AND BONDING OF ELECTRICAL SYSTEMS.

3.3 INSPECTION

A. Systems to meet all the requirements of the CSFM and IOR and AHJ and shall be approved thereby before installation and prior to final acceptance.

3.4 LOCATION

A. Before installation, verify exact location of control equipment and outlets. The Owner reserves the right to relocate system components within a radius of 10' at no increase in cost before rough-in work is started for the respective component.

3.5 WIRING

A. Furnish all conductors, equipment, terminal strips, etc., and labor to install a complete and operable system. All cable conductors shall be color coded and numbered for identification at all terminals. Green shall be for grounding conductor only. Use red insulation and or red jacketing on all fire alarm cable.

3.6 TESTING

A. After all equipment specified herein for each system has been installed and is in operating condition, conduct performance tests to determine if the installation and components comply with these specifications. Furnish competent personnel, all test material and approved test instruments and conduct the tests under supervision of factory personnel, in the presence of the Engineer, the building and fire inspecting agencies.
   1. The contractor's job foreman, in the presence of a representative of the manufacturer, a representative of the owner, and the fire department shall operate every installed device to verify proper operation and correct annunciation at the control panel.
   2. At least on half of all tests shall be performed on battery standby power.
   3. Where application of heat would destroy any detector, it may be manually activated.
   4. The signaling line circuits and notification appliance circuits shall be opened in at least two (2) locations to verify the presence of supervision.
   5. When the testing has been completed to the satisfaction of the contractor representative IOR, representatives of the manufacturer and owner, a notarized letter co-signed by each attesting to the satisfactory completion of said testing shall be forwarded to the owner and the authority having jurisdiction.
   6. The contractor shall leave the fire alarm system in proper working order, and, without additional expense to the owner, shall replace any defective materials or equipment provided by him under this contract within two years from the date of final acceptance by the awarding authority.
   7. The local responding fire department must be notified prior to the final test in accordance with local requirements and when requested, participate in system testing and evaluation.

3.7 REPORT

A. Prepare written report of final test results, signed by witnessing parties. Submit to the Engineer in triplicate for final approval.

END OF SECTION 28 3100