Specifications
Project No. 2024022

Baldwin ES Modernization

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San Jose, CA 95119

DSA App No. 01-122542

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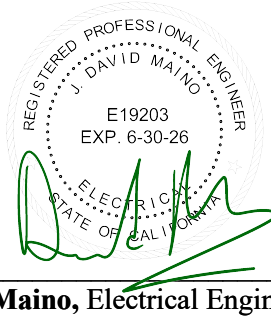
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SECTION 017416 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification sections, apply to work of this section.

1.2 SUMMARY

A. Section Includes:

1. Cutting and patching existing construction.

1.3 DESCRIPTION OF REQUIREMENTS

A. Definition: "Cutting and patching" includes cutting into existing construction to provide for the installation or performance of other work and subsequent fitting and patching required to restore surfaces to their original condition. Cutting and patching shall be coordinated with Hazardous Materials Abatement throughout the project.

1. "Cutting and patching" is performed for coordination of the work, to uncover work for access or inspection, to obtain samples for testing, to permit alterations to be performed or for other similar purposes.
2. Cutting and patching performed during the manufacture of products, or during the initial fabrication, erection or installation processes is not considered to be "cutting and patching" under this definition. Drilling of holes to install fasteners and similar operations are also not considered to be "cutting and patching".

B. "Selective Demolition" are recognized as related-but-separate categories of work, which may or may not require cutting and patching as defined in this section; refer to Section 024119 "Selective Demolition”.

C. Refer to other sections of these specifications for specific cutting and patching requirements and limitations application to individual units of work.

D. Unless otherwise specified, applicable requirements of this section apply to mechanical and electrical work. Refer to Division 21 through Division 27 sections for additional requirements and limitations on cutting and patching of mechanical and electrical work.

1.4 PREINSTALLATION MEETINGS

A. Cutting and Patching Conference: Conduct conference at Project site.

B. Prior to submitting cutting and patching plan, review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting and patching work. Inform Architect of scheduled meeting.

1.5 QUALITY ASSURANCE

A. Requirements for Structural Work: Do not cut and patch structural work in a manner that would result in a reduction of load-carrying capacity or of load-deflection ratio.

B. Before cutting and patching the following categories of work, obtain the Architect/Engineer's approval to proceed with cutting and patching as described in the procedural proposal for cutting and patching.

1. Structural steel
2. Miscellaneous structural metals, including lintels, equipment supports, stair systems and similar categories of work.
3. Foundation construction.
4. Timber and primary wood framing.
5. Bearing and retaining walls.
6. Exterior curtain wall construction.
7. Piping, ductwork, vessels and equipment.

C. Operational and Safety Limitations: Do not cut and patch operational elements or safety related components in a manner that would result in a reduction of their capacity to perform in the manner intended, including energy performance, or that would result in increased maintenance, or decreased operational life or decreased safety.

D. Before cutting and patching the following elements of work, and similar work elements where directed, obtain the Architect/ Engineer's approval to proceed with cutting and patching as proposed in the proposal for cutting and patching.

1. Primary operational systems and equipment:
2. Water/moisture/vapor/air/smoke barriers, membranes and flashings.
3. Noise and vibration control elements and systems.
4. Control, communication, conveying, and electrical wiring systems.

E. Visual Requirements: Do not cut and patch work exposed on the building's exterior or in its occupied spaces, in a manner that would, in the Architect/Engineer's opinion, result in lessening the building's aesthetic qualities. Do not cut and patch work in a manner that would result in substantial visual evidence of cut and patch work. Remove and replace work judged by the Architect/ Engineer to be cut and patched in a visually unsatisfactory manner.

1.6 SUBMITTALS

A. Procedural Proposal for Cutting and Patching: Where prior approval of cutting and patching is required, submit proposed procedures for this work well in advance of the time

work will be performed and request approval to proceed. Include the following information, as applicable, in the submittal.

1. Describe nature of the work and how it is to be performed, indicating why cutting and patching cannot be avoided. Describe anticipated results of the work in terms of changes to existing work, including structural, operational and visual changes as well as other significant elements.
2. List products to be used and firms that will perform work.
3. Give dates when work is expected to be performed.
4. List utilities that will be disturbed or otherwise be affected by work, including those that will be relocated and those that will be out-of-service temporarily. Indicate how long utility service will be disrupted.

B. Where cutting and patching of structural work involves the addition of reinforcement, submit details and engineering calculations to show how that reinforcement is integrated with original structure to satisfy requirements.

C. Approval by the Architect/Engineer to proceed with cutting and patching work does not waive the Architect/Engineer's right to later require complete removal and replacement of work found to be cut and patched in an unsatisfactory manner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Except as otherwise indicated, or as directed by the Architect/Engineer, use materials for cutting and patching that are identical to existing materials. If identical materials are not available, or cannot be used, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Use materials for cutting and patching that will result in equal-or-better performance characteristics.

PART 3 - EXECUTION

3.1 INSPECTION

A. Before cutting, examine the surfaces to be cut and patched and the conditions under which the work is to be performed. If unsafe or otherwise unsatisfactory conditions are encountered, take corrective action before proceeding with the work.

B. Before the start of cutting work, meet at the work site with all parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict between the various trades. Coordinate layout of the work and resolve potential conflicts before proceeding with the work.

3.2 PREPARATION

A. Temporary Support: To prevent failure provide temporary support of work to be cut.

B. Protection: Protect other work during cutting and patching to prevent damage. Provide protection from adverse weather conditions for that part of the project that may be exposed during cutting and patching operations.

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

D. Take precautions not to cut existing pipe, conduit or duct serving the building but scheduled to be relocated until provisions have been made to bypass them.

3.3 PERFORMANCE

A. General: Employ skilled workmen to perform cutting and patching work. Except as otherwise indicated or as approved by the Architect/Engineer, proceed with cutting and patching at the earliest feasible time and complete work without delay.

B. Cutting: Cut the work using methods that are least likely to damage work to be retained or adjoining work. Where possible review proposed procedures with the original installer; comply with original installer's recommendations.

1. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut through concrete and masonry using a cutting machine such as a carborundum saw or core drill to insure a neat hole. Cut holes and slots neatly to size required with minimum disturbance of adjacent work. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces. Temporarily cover openings when not in use.

C. Patching: Patch with seams which are durable and as invisible as possible. Comply with specified tolerances for the work.

1. Where feasible, inspect and test patched areas to demonstrate integrity of work.
2. Restore exposed finishes of patched areas and where necessary extend finish restoration into retained adjoining work in a manner which will eliminate evidence of patching and refinishing.
3. Where removal of walls or partitions extends one finished area into another finished area, patch and repair floor and / or wall surfaces in the new space to provide an even surface of uniform color and appearance. If necessary to achieve uniform color and appearance, remove existing floor and wall coverings and replace with new materials.
4. Where patch occurs in a smooth painted surface, extend final paint coat over entire unbroken surface containing patch to the next plane transition or change in material, after patched area has received prime and base coat.
5. Patch, repair or rehang existing ceilings as necessary to provide an even plane surface of uniform appearance.

6. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

3.4 CLEANING

A. Thoroughly clean areas and spaces where work is performed or used as access to work. Completely remove excess paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

END OF SECTION 017416

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous demolition and construction waste.
2. Recycling nonhazardous demolition and construction waste.
3. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:
1. Section 018113.71 “Sustainable Design Requirements – CALGreen Non-Residential Mandatory”
2. Section 024119 “Selective Demolition” for requirements for refrigerant recovery.
3. Section 028100 “Disposal of Lamps, Ballasts and Other Universal Waste” for removal and disposal of PCB-Containing lamps and ballasts, mercury-containing thermostats and other items that fall within California’s list of prohibited Universal Waste materials.

1.3 DEFINITIONS

A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.

C. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner’s property.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 MATERIALS OWNERSHIP

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

1.5 ACTION SUBMITTALS

A. Documentation General: Provide documentation to the enforcing agency which demonstrates compliance with Cal Green Section 5.408.1.1 through 5408.1.3.

B. Waste Management Plan: Submit plan within 30 days of date established for the Notice of Award. Plan must include the following:

1. Strategies to reduce the generation of waste during Project design and construction.
2. Waste diversion goals for Project, identifying the materials (both structural and nonstructural) targeted for recycling, reuse, or salvage and identifying the target diversion percentage (at least 50 percent).
3. Where materials will be taken, including expected diversion rates for each material.

1.6 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Submit report concurrent with each application for payment. Show waste management plan compliance status.

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons.
4. Quantity of waste salvaged, both estimated and actual in tons.
5. Quantity of waste recycled, both estimated and actual in tons.
6. Total quantity of waste recovered (salvaged plus recycled) in tons.
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. Waste Reduction Calculations: Before request for Substantial Completion, calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. Landfill Disposal Records: Indicate receipt and acceptance of waste by landfill facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

G. Qualification Statements: For refrigerant recovery technician.

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

I. Refrigerant Recovery: Comply with requirements in Section 024119 "Selective Demolition" for refrigerant recovery submittals.

1.7 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, or individual employed and assigned by General Contractor, with a record of successful waste management coordination of projects with similar requirements. Superintendent may serve as Waste Management Coordinator.

B. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction.

C. Waste Management Conference(s): Conduct conference(s) at Project site to comply with requirements in Division 01 requirements. Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan including responsibilities of each contractor and waste management coordinator.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.8 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan in accordance with requirements in this Section. Plan must include provisions for waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

1. Implement waste management plan at start of construction.
2. Review waste management plan at pre-construction meeting and progress meetings.
3. Distribute approved waste management plan to affected parties.
4. Oversee plan implementation, instruct construction personnel for plan compliance, and document plan results.

B. Waste Identification: Indicate anticipated types and quantities of waste generated by the Work. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work in compliance with Section 024119 "Selective Demolition."
2. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
3. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
4. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

D. When purchasing products, require the following to prevent waste when applicable.

1. Ensure correct quantity is delivered to site.
2. Choose products with minimal or no packaging.
3. Require returnable pallets and containers.
4. Require suppliers to take or buy-back rejected and unused items.

1.9 UNIVERSAL WASTE

A. Provide verification that Universal Waste items such as fluorescent lamps and ballasts and mercury containing thermostats are disposed of properly and diverted from landfills. See Section 028100 “Disposal of Lamps, Ballasts and Other Universal Waste”.

PART 2 - PRODUCTS

2.1 RECYCLING RECEIVERS AND PROCESSORS

A. Recycling Receivers and Processors:

1. The General Contractor shall be responsible for coordinating all recycling receivers and processors for demolition and construction wastes throughout the course of the project.
2. List below is provided for information only; available recycling receivers and processors include, but are not limited to, the following:

    a. General Building Materials:

        1) Green Waste Recovery, 625 Charles St., San Jose, CA 408.283.4800
        2) Waste Management Office, 6175 South Front Road, Livermore, CA 925.447.1300
        3) BFI Waste Services of Salinas, 271 Rianda St., Salinas, CA 831.775.3840

2.2 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of minimum 65 percent by weight of total nonhazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:

1. Demolition Waste:
    a. Wood studs.
    b. Wood joists.
    c. Plywood and oriented strand board.
    d. Wood paneling.
    e. Wood trim.
    f. Insulation.
    g. Rough hardware.
    h. Door hardware.
    i. Doors and frames.
    j. Windows.
    k. Glazing.
    l. Gypsum board.
    m. Acoustical tile and panels.
    n. Carpet.
    o. Carpet pad.
    p. Equipment.
    q. Cabinets.
    r. Plumbing fixtures.
    s. Piping.
    t. Supports and hangers.
    u. Valves.
    v. Mechanical equipment.
    w. Electrical conduit.
    x. Copper wiring.
    y. Lighting fixtures.

z. Lamps.
aa. Ballasts.
bb. Electrical devices.

2. Construction Waste:
a. Lumber.
b. Wood sheet materials.
c. Wood trim.
d. Metals.
e. Insulation.
f. Gypsum board.
g. Piping.
h. Electrical conduit.
i. Packaging: Regardless of salvage/recycle goal indicated above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

1) Paper.
2) Cardboard.
3) Boxes.
4) Plastic sheet and film.
5) Polystyrene packaging.
6) Wood crates, pallets, shipping containers
7) Plastic pails.

j. Construction Office Waste: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following construction office waste materials:

1) Paper.
2) Aluminum cans.
3) Glass containers.

B. Waste Stream Reduction Alternative

1. If the combined weight of new construction disposal does not exceed two pounds per square foot of building area, it may be deemed to meet the 65 percent minimum requirement as approved by the enforcing agency.

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."

B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged and recycled.
2. Comply with requirements for controlling dust and dirt, environmental protection, and noise control, as required by Owner.

3.2 SALVAGING DEMOLITION WASTE

A. Comply with requirements in Section 024119 "Selective Demolition" and Section 028100 “Disposal of Lamps, Ballasts and Other Universal Waste” for salvaging demolition waste.

B. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

C. Salvaged Items for Sale or Donation: Not permitted on Project site.

D. Salvaged Items for Owner's Use: Handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

E. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

F. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

G. Plumbing Fixtures: Separate by type and size.

H. Lighting Fixtures: Separate lamps by type and protect from breakage.

I. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

C. Preparation of Waste: Prepare and maintain recyclable waste materials in accordance with recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

    a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

3.4 RECYCLING DEMOLITION WASTE

A. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

B. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.
2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

C. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

D. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

1. Separate suspension system, trim, and other metals from panels and tile and sort with other metals.

E. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.

1. Store clean, dry carpet in a closed container or trailer for a Carpet Reclamation Agency or carpet recycler.

F. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

G. Plumbing Fixtures: Separate by type and size.

H. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

I. Lighting Fixtures: Separate lamps by type and protect from breakage.

J. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

K. Conduit: Reduce conduit to straight lengths and store by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

A. General: Contractor shall coordinate recycling of construction waste with product provider so that to the extent possible scrap materials, drop and clean cut-offs may be recycled through the product manufacturer and re-enter in the manufacturing process. When not possible, construction waste should go through a recycling facility, in lieu of entering the land fill.

B. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

C. Wood Materials:

1. Stack large clean cut-offs of lumber, nail free, i.e. pieces of scrap, drop, etc. in dry location and remove to off –site recycling facility.

D. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location.

1. Coordinate with gypsum manufacturer to reclaim and recycle unused scraps or drop material so that it may be reused as at manufacturer’s plant of origin or other recycling facility.

E. Paint: Seal containers and store by type.

3.6 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged or recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Burning of waste materials is not permitted.

C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION 017419

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set(s) of marked-up record prints.
2. Number of Copies: Submit copies of Record Drawings as follows:

a. Initial Submittal:

1) Submit one paper-copy set(s) of marked-up record prints.
2) Submit PDF electronic files of scanned record prints and one set(s) of file prints.
3) Submit Record Digital Data Files and one set(s) of plots.
4) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:

1) Submit one paper-copy set(s) of marked-up record prints.
2) Submit Record Digital Data Files and one set(s) of Record Digital Data File plots.
3) Plot each drawing file whether or not changes and additional information were recorded.

B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and Contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

E. Reports: Submit written report weekly indicating items incorporated into Project Record Documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

1.4 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an acceptable drawing technique.
c. Record data as soon as possible after obtaining it.
d. Record and check the markup before enclosing concealed installations.
e. Cross-reference record prints to corresponding photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Depths of foundations.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities.
j. Changes made by Change Order or Change Directive.
k. Changes made following Architect's written orders.

l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect and Construction Manager. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Format: Same digital data software program, version, and operating system as for the original Contract Drawings.
2. Format: DWG.
3. Format: Annotated PDF electronic file with comment function enabled.
4. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
5. Refer instances of uncertainty to Architect for resolution.
6. Architect will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.

C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:

a. Project name.
b. Date.
c. Designation "PROJECT RECORD DRAWINGS."
d. Name of Architect and Construction Manager.
e. Name of Contractor.

1.5 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation, where installation varies from that indicated in Specifications, addenda, and Contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

B. Format: Submit record specifications as [annotated PDF electronic file] [paper copy] [scanned PDF electronic file(s) of marked-up paper copy of Specifications].

1.6 RECORD PRODUCT DATA

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.

B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

C. Format: Submit Record Product Data as annotated PDF electronic file.

1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

1.7 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic file.

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

1.8 MAINTENANCE OF RECORD DOCUMENTS

A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's and Construction Manager's reference during normal working hours.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017839

SECTION 018113.71 - SUSTAINABLE DESIGN REQUIREMENTS - CALGREEN NON-RESIDENTIAL MANDATORY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: General requirements and procedures for compliance with and certification from 24 CCR 11 (hereafter, "CALGreen").

1. Some CALGreen requirements depend on product selections and may not be specifically identified as CALGreen requirements. Compliance with CALGreen requirements may be used as one criterion to evaluate substitution requests and comparable product requests.

1.2 DEFINITIONS

A. VOCs: Volatile organic compounds.

B. Composite Wood Products: Hardwood plywood, particleboard, and medium-density fiberboard. Composite wood products do not include hardboard, structural plywood.

C. Recycled Content: Component of a material made of recycled materials. Recycled material can be derived from two sources: pre-consumer, also known as "post-industrial," or "post-consumer." "Post-consumer recycled material" refers to items, such as aluminum cans, that have been in the consumer market. Post-industrial material is waste generated from the original manufacturing process that is used again.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site. Review CALGreen requirements and action plans for compliance with requirements.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Respond to questions and requests from Architect about CALGreen requirements that depend on product selection or product qualities. Document responses as informational submittals.

B. Environmental Management System: Document the following:

1. Environmental policy.
2. Regulatory compliance and training.
3. Environmental risk assessment that shows sensitive environmental areas and ranks potential risks that may arise from the construction.

4. Environmental risk management strategies.
5. Environmental management roles, responsibilities, and reporting structure for the construction phase.
6. Site and work instructions for site personnel, outlining environmental procedures during construction.
7. Environmental inspection checklists.
8. Records of compliance.

1.5 ACTION SUBMITTALS

A. General: Submit additional sustainable design submittals required by other Specification Sections.

B. Sustainable Design Documentation Submittals:

1. Stormwater pollution prevention plan.
2. Product data for irrigation system components, including, but not limited to, the following:

    a. Sprinkler Heads: Indicate degree of head rotation and spray characteristics/pattern.
    b. Controllers and sensors.

3. Product data and schedules for plumbing fixtures and fittings. Include rated capacities and WaterSense certification where applicable.
4. Product data for residential appliances, indicating that products are Energy Star rated.
5. Environmental management system documents.
6. Lighting controls.
7. Environmental product declarations.
8. Third-party certifications based on multiple-attribute standards.
9. Third-party-certified life-cycle product assessments.
10. Product data, manufacturer’s certifications, chain-of-custody certification, or other documentation acceptable to authorities having jurisdiction; for products containing composite wood, agrifiber products, or wood glues, indicate compliance with California Air Resource Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Missions from Composite Wood."
11. Construction waste management plan complying with Section 017419 "Construction Waste Management and Disposal."
12. Product data and laboratory test reports for adhesives and sealants indicating VOC content and compliance with requirements for low-emitting materials.
13. Certificates for carpet and undercarpet adhesives indicating compliance with Carpet and Rug Institute’s Green Label Plus testing program.
14. Product data and laboratory test reports for paints and coatings indicating VOC content and compliance with requirements for low-emitting materials.
15. Laboratory test reports for hard flooring, insulation, acoustical ceilings, and wall coverings, indicating compliance with requirements for low-emitting materials, as defined in "Low-Emitting Materials" Article.

1.6 INFORMATIONAL SUBMITTALS

A. Project Materials Cost Data: Submit statement indicating total cost for materials used for the Work. Costs exclude labor, overhead, and profit. Include breakout of costs for the following categories of items:

1. Plumbing.
2. Mechanical.
3. Electrical.
4. Specialty items, such as elevators and equipment.
5. Wood-based construction materials.

B. Sustainable Design Action Plans: Submit preliminary submittals within 30 days of date established for the Notice to Proceed indicating how the following requirements will be met:

1. CALGreen checklist for mandatory measures.
2. List of products with environmental product declarations.
3. List of products complying with requirements for multiple-attribute standards.
4. List of products complying with requirements for life-cycle product assessments.
5. Environmental policy.
6. Waste management plan complying with Section 017419 "Construction Waste Management and Disposal."

C. Sustainable Design Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with sustainable design action plans.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide products and procedures necessary to comply with CALGreen requirements referenced in the Evaluations. Although other Sections may specify some requirements that contribute to referenced CALGreen requirements, determine additional materials and procedures necessary to comply with CALGreen requirements indicated.

2.2 LOW-EMITTING MATERIALS

A. Adhesives and Sealants:

1. For field applications inside the building, adhesives and sealants shall comply with the following VOC content limits:

a. Wood Glues: 30 g/L.
b. Metal-to-Metal Adhesives: 30 g/L.
c. Adhesives for Porous Materials (except Wood): 50 g/L.

d. Subfloor Adhesives: 50 g/L.
e. Plastic Foam Adhesives: 50 g/L.
f. Carpet Adhesives: 50 g/L.
g. Carpet Pad Adhesives: 50 g/L.
h. VCT and Asphalt Tile Adhesives: 50 g/L.
i. Cove Base Adhesives: 50 g/L.
j. Gypsum Board and Panel Adhesives: 50 g/L.
k. Rubber Floor Adhesives: 60 g/L.
l. Ceramic Tile Adhesives: 65 g/L.
m. Multipurpose Construction Adhesives: 70 g/L.
n. Fiberglass Adhesives: 80 g/L.
o. Contact Adhesive: 80 g/L.
p. Structural Glazing Adhesives: 100 g/L.
q. Wood Flooring Adhesive: 100 g/L.
r. Single-Ply Roof Membrane Adhesive: 250 g/L.
s. Special-Purpose Contact Adhesive (Contact Adhesive That Is Used to Bond Melamine Covered Board, Metal, Unsupported Vinyl, Rubber, or Wood Veneer 1/16 Inch or Less in Thickness to Any Surface): 250 g/L.
t. Plastic Cement Welding Compounds: 250 g/L.
u. ABS Welding Compounds: 325 g/L.
v. CPVC Welding Compounds: 490 g/L.
w. PVC Welding Compounds: 510 g/L.
x. Adhesive Primer for Plastic: 550 g/L.
y. Architectural Sealants: 250 g/L.
z. Nonmembrane Roof Sealants: 300 g/L.
aa. Single-Ply Roof Membrane Sealants: 450 g/L.
bb. Other Sealants: 420 g/L.

2. For field applications inside the building, adhesives and sealants must comply with the requirements of SCAQMD Rule 1168 for VOC limits and prohibition of certain toxic compounds, or local code when tested in accordance with the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Carpet, cushion, and undercarpet adhesives will comply with CRI's Green Label Plus testing program.

C. Paints: For field applications inside the building, wall paints must comply with local code requirements when tested in accordance with the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. Resilient Flooring: Flooring must be certified by the Resilient Floor Covering Institute and/or be compliant when tested in accordance with the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Flooring must also comply with the Collaborative for High Performance Schools (CHPS) requirements.

E. Thermal Insulation: Provide insulation complying with CALGreen Tier 1 or 2 requirements.

F. Ceiling and Wall Panels: Acoustical ceiling and wall-cladding products must comply with the VOC emissions limits defined in the CHPS criteria and be listed in the CHPS Pre-Approved Products database or have a Greenguard Certification Program.

PART 3 - EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT

A. CALGreen requires use of a construction waste management plan outlining how waste will be divided on the construction site, as well as how often it will be hauled to a landfill or recycling center and by whom.

B. CALGreen includes a sample plan outlining all specific requirements of the plan.

C. Comply with Section 017419 "Construction Waste Management and Disposal."

3.2 COMMISSIONING

A. CALGreen requires commissioning of the building mechanical and electrical systems to ensure proper installation and optimized performance as the building starts to be occupied. It also requires a systematic quality assurance process that spans the entire design and construction process and includes verifying and documenting that building systems and components are planned, designed, installed, tested, operated, and maintained to meet Owner’s project requirements.

END OF SECTION 018113.71

SECTION 024119 - SELECTIVE DEMOLITION

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. Extent of selective demolition work is indicated on drawings.

B. Should any existing conditions such a deterioration or non-complying construction be discovered that is not covered by the DSA approved documents wherein the finished work will not comply with Title 24, California Code of Regulations, a construction change document, or a separate set of plans and specifications, detailing and specifying the required repair work shall be submitted to and approved by DSA before proceeding with the repair work.

C. Section Includes:

1. Demolition and removal of selected portions of exterior or interior of building or structure and site elements.
2. Removal and salvage of existing items for delivery to Owner and removal of existing items for reinstallation.

D. Removal Work Specified Elsewhere:

1. Cutting non-structural floors and walls for piping, ducts, and conduit is included with the work of the respective mechanical and electrical Divisions 21 through 27 specification sections.

E. Related Requirements:
1. Section 017416 “Cutting and Patching”.
2. Section 017419 “Construction Waste Management and Disposal”.

1.3 DEFINITIONS

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

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner as indicated.

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1.4 MATERIALS OWNERSHIP

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

1.5 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

1.6 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.
6. Review and finalize protection requirements.
7. Review procedures for noise control and dust control.
8. Review storage, protection, and accounting for items to be removed for salvage or reinstallation.

1.7 INFORMATIONAL SUBMITTALS

A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

B. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.

5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

C. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations.

D. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.8 CLOSEOUT SUBMITTALS

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

1.9 FIELD CONDITIONS

A. Owner will be continuously occupying areas of the building immediately adjacent to areas of selective demolition. Conduct selective demolition work in manner that will minimize need for disruption of Owner's normal operations. Provide minimum of 72 hours advance notice to Owner of demolition activities which will severely impact Owner's normal operations.

B. Owner assumes no responsibility for actual condition of items of structures to be demolished.

1. Owner will remove and salvage selected elements from the area of work prior to start of demolition or during progress of work. Elements so affected will be clearly marked/identified and are to be excluded from work.
2. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical. However, variations within structure may occur by Owner's removal and salvage operations prior to start of selective demolition work.

C. Partial Demolition and Removal: Items indicated to be removed but of salvable value to Contractor may be removed from structure as work progresses. Transport salvaged items from site as they are removed.

1. Storage or sale of removed items on site will not be permitted.

D. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

E. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

F. Storage or sale of removed items or materials on-site is not permitted.

G. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to commencement of selective demolition work, inspect areas in which work will be performed. Photograph existing conditions to structure surfaces, equipment or to surrounding properties which could be misconstrued as damage resulting from selective demolition work; file with Owner's Representative prior to starting work.

B. Permits: Where applicable, Contractors shall give all notices to governmental agencies, obtain all required permits, arrange for agency inspections and pay all associated fees related to legally mandated environmental protection regulations.

C. Verify that utilities have been disconnected and capped before starting selective demolition operations.

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

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Arrange to shut off utilities with utility companies.
2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building. Provide minimum of 72 hours advance notice to Owner if shut- down of service is necessary during change-over.
3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.3 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling as required by Owner.

B. Cover and protect furniture, equipment and fixtures to remain from soiling or damage when demolition work is performed in rooms or areas from which such items have not been removed.

C. Erect and maintain dust-proof partitions and closures as required to prevent spread of dust or fumes to occupied portions of the building.

D. Provide weatherproof closures for exterior openings resulting from demolition work.

E. Remove temporary barricades and protections where hazards no longer exist.

3.4 SELECTIVE DEMOLITION, GENERAL

A. Perform all selective demolition work necessary for installation of new work, including but not limited to, removal of walls, foundations, openings, electrical, mechanical, plumbing, roofing and finishes.

B. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain fire watch during and for at least 1 hours after flame-cutting operations.
6. Maintain adequate ventilation when using cutting torches.
7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
10. For interior slabs on grade, use removal methods that will not crack or structurally disturb adjacent slabs or partitions. Use power saw where possible.
11. For renovation work remove existing door hardware indicated to be replaced by new hardware as shown in the door and hardware schedules.
12. Remove existing door hardware for new door hardware designated on opening and hardware schedules.
13. If unanticipated mechanical, electrical or structural elements which conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to Owner's Representative in written, accurate detail. Pending receipt of directive from Owner's Representative rearrange selective demolition schedule as necessary to continue overall job progress without delay.
14. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."

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

D. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner and obtain receipt.
5. Protect items from damage during transport and storage.

E. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

F. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and recycle or dispose of them according to Section 017419 "Construction Waste Management and Disposal."

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

3.7 CLEAN UP AND REPAIR

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

B. Upon completion of demolition work, remove tools, equipment and demolished materials from site. Remove protections and leave interior areas broom clean.

C. Repair all surfaces to match existing surfaces of doors and frames at removed hardware conditions left evident after new hardware installations.

D. Repair demolition performed in excess of that required. Return structures and surfaces to remain to condition existing prior to commencement of selective demolition work. Repair adjacent construction or surfaces soiled or damaged by selective demolition work. All grass and lawn areas altered or destroyed due to construction work shall be replaced with sod of similar grass type as existing adjacent grasses. Contractor shall ensure lawn is level and returned to its original condition to the satisfaction of the architect.

E. Repair all surfaces to match existing adjacent surfaces where existing system has been removed and left evident after new system installation, i.e. ducts, louvers, conduits, etc.

END OF SECTION 024119

SECTION 028100 - DISPOSAL OF LAMPS, BALLASTS AND OTHER UNIVERSAL WASTE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Removal and disposal of PCB-Containing lamps and ballasts.
2. Removal and disposal of mercury-containing thermostats
3. Other items that falls within California's list of prohibited Universal Waste materials.

B. Related Requirements:

1. Section 017410 "Construction Waste Management and Disposal"
2. Section 024119 "Selective Demolition"

1.3 DEFINITIONS

A. Universal Waste: Materials found in the following identified categories:

1. Batteries
2. Electronic Waste
3. Cathode Ray Tube (CRT)
4. Cathode Ray Tube (CRT) Glass
5. Lamps
6. Mercury Wastes
7. Non-Empty Aerosol Cans
8. PV Modules

1.4 REGULATORY REQUIREMENTS

A. The applicable sections, latest editions and addenda of the following government regulations, codes, industry standards and recommended practices, form a part of this specification. Nothing in these specifications is to be construed as permitting work not conforming to these regulations.

1. Environmental Protection Agency (EPA) Title 40, CFR Parts 260-279.
2. United States Code, Chapter 42, Resource Conservation and Recovery Act (RCRA)

3. California Health and Safety Code (HSC) Division 20, Chapter 6.5: Hazardous Waste Control Law
4. California Code of Regulations (CCR) Title 22, Division 4.5 Environmental Health Standards for the Management of Hazardous Waste, Chapter 22: Standards for Universal Waste Management.
5. Department of Transportation (DOT) Title 49, Code of Federal Regulations (CFR) Part 173 Subpart J.
6. Federal Occupational Safety and Health Administration (OSHA) Title 29, CFR 1910 Sections 106, 133, 134, 144.
7. Department of Toxic Substances Control (DTSC)
8. State Occupational Safety and Health Administration. (OSHA)
9. National Electrical Code (NEC).
10. All applicable County and City codes, ordinances and regulations.

B. The contractor is cautioned that they are responsible for ascertaining the extent to which these regulations affect the operations resulting from this solicitation and to comply therewith.

1.5 PROJECT DESCRIPTION

A. The Contractor shall provide all labor, materials, equipment, transportation, documentation and services necessary for the destruction of all PCB ballast's, lamps, mercury-containing thermostats and any other universal waste materials associated with the project.

B. The BASE BID shall include the cost of disposal of universal waste as described in this specification.

C. All disposals shall conform to regulatory entities listed above.

D. An EPA approved incinerator shall dispose of all PCB-containing material, solid or liquid. Separate the PCB-containing portions of the ballasts from the non-PCB portions. The non-PCB portions shall be processed to reclaim recyclable components such as copper and steel.

E. Ballast's carcasses and lamps potentially containing mercury shall be totally destructed by an EPA approved facility.

F. Landfill of any PCB or mercury waste is prohibited.

1.6 QUALITY ASSURANCE

A. Contractor Qualifications:

1. Each bidder shall provide written evidence that, as a major part of this business, the bidder has been engaged in PCB and mercury disposal activities including processing and destruction of PCB ballasts, lamps, thermostats and other universal waste containing mercury. Related activities shall include transportation, EPA required documentation, servicing and storage of high and low concentrations of

PCB fluids and solids, and destruction of PCB carcasses and disposal of lamps and thermostats potentially containing mercury.

2. Bidder's service personnel shall be, at a minimum, qualified individuals who have completed a formal training program in the handling, processing and safety precautions associated with PCB fluids and mercury and other universal waste.
3. Each bidder shall submit a reference list of twenty or more customers they have successfully contracted with for PCB, mercury and universal waste services. The customers' name, address, telephone number and key contact person with the company shall be approved with the bid.
4. The bidder's PCB, mercury and universal waste handling facility must have a full commercial operating permit from EPA and shall submit a copy of this permit with the bid.

1.7 CONTAINERZATION AND MARKING

A. All PCB ballasts and hazardous materials, including lamps, thermostats and other universal waste potentially containing mercury, generated from project activities and clean up operations shall be placed in EPA specified containers. Only approved drums, tippler cans or wood crates conforming to EPA specifications shall be used to containerize non- leaking ballasts and lamps.

B. All containers used shall be properly sealed, marked, labeled and dated.

1.8 TRANSPORTATION TO DESTRUCTION/SERVICING FACILITIES

A. All ballasts, lamps, thermostats and other universal waste potentiality containing mercury shall be transported to an EPA-approved processing/destruction facility.

B. All PCB-containing capacitors and components shall be transported to an EPA-approved incinerator.

C. For the disposal of leaking PCB ballasts and associated waste, the contractor and/or subcontractor and vehicles must be licensed for the transportation and hauling of extremely hazardous wastes. The drivers of these vehicles shall be trained in the laws, rules and regulations governing the transportation of PCB materials. The vehicles must be plainly marked as specified by the U.S. Department of Transportation, EPA, State Department of Health Services, State Highway Patrol and State Department of Transportation.

1.9 INSURANCE

A. The Contractor shall possess the following minimum insurance and provide certificates from qualified insurers attesting same.

1. Pollution Liability Insurance - $5,000,000 per occurrence, $5,000,000 aggregate and covering all necessary or reasonable costs or expenses of removing, nullifying, cleaning up, or rendering ineffective any accidental spillage.

2. Comprehensive General Liability - $5,000,000 combined single limit per occurrence.
3. Comprehensive Automobile Liability - $5,000,000 combined single limit per occurrence.

B. Evidence of reliable insurance coverage and assets to fully indemnify against long-term liabilities and/or catastrophic occurrences shall be a part of the evaluation criteria for award of the contract.

1.10 SUBMITTALS

A. The Contractor shall provide the Owner with comprehensive information on all firms to be involved in PCB, mercury and universal waste related work activities as part of this contract prior to commencement of the project. Such information shall include a minimum of:

1. Name, address, telephone number, and EPA ID number, State Transporters ID number and Hauler Registration number of the firm(s) responsible for the transportation of PCB solids and fluids, ballast, lamp, thermostat or other universal waste potentially containing mercury sealed containers.
2. Name, address, telephone number and EPA ID number of the firm(s) responsible for the ultimate disposal/destruction of all PCB articles and any other hazardous waste, including lamps, thermostats and other universal waste potentially containing mercury generated in the course of the work.
3. Name, address, telephone number and EPA ID number of the firm(s) responsible for the ultimate final destruction of the ballasts and reclamation of recyclable components.

B. The Contractor shall provide the Owner with comprehensive documentation of all work activities upon completion of the work and prior to final payment. Such documentation shall include a minimum of:

1. Type and size of containers, contents, weight or unit of measure, date transported and name, address, telephone number and EPA ID number of processing and/or disposal facility.
2. Written certification, i.e., Uniform Hazardous Waste Manifest demonstrating receipt of material at the disposal/incineration facility. Such certification shall be signed by the person authorized by the disposal/incineration facility to accept PCB items for disposal.
3. Certificate of Destruction for PCB liquids, solids and ballast carcasses and lamps, thermostats or other universal waste potentially containing mercury.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 028100

SECTION 03 10 00

CONCRETE FORMWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Formwork for cast-in-place concrete.

B. Form openings for mechanical and electrical work.

C. Coordinate installation of items supplies under other specification sections.

1.2 RELATED SECTIONS

A. Section 03 30 00: Cast-in-Place Concrete

B. Section 03 20 00: Concrete Reinforcing

C. Mechanical and electrical items to be embedded in concrete.

1.3 QUALITY ASSURANCE

A. Design Requirements:

1. All work shall California Code of Regulations. Title 24, 2022 edition, also known as California Building Code (CBC) and DSA Amendments.

2. Responsibility: Design of formwork is the Subcontractor's responsibility. Comply with the following, except as modified by the Building Code or these specifications.
   a. ACI 301 - "Specifications for Structural Concrete for Buildings."
   b. ACI 347 - "Recommended Practice for Concrete Formwork."
   c. ACI 303R - "Guide to Cast-in-Place Architectural Concrete Practice."
3. Allowable Tolerances:
   a. Construct formwork to provide completed cast-in-place concrete surfaces complying with the tolerances specified in ACI 347.
   b. Note special tolerance requirements for locations of drains where indicated on drawings.

1.4 SUBMITTALS

A. Product Data: Submit Manufacturer's data and installation instructions for proprietary materials such as form coatings, manufactured form systems, ties and accessories.

B. Submit manufacturer's certification that form release agent will provide clean, stainfree surfaces of concrete and not interfere with bond of applied finishes.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver form release agents in manufacturer's sealed and trademarked containers.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. General: Form material shall be as required to produce continuous, straight, smooth exposed surfaces. Materials selected shall be satisfactory to Architect for effect on finished appearance of concrete. Architectural concrete formwork shall be of one material throughout the work, for all similar types of concrete surfaces.

B. Exposed Non-Architectural Concrete:
1. Metal or APA graded Plyform, Grade BB, Class I or II, or HDO plywood exterior type, each piece graded, no mill oiling. Use one form face material throughout the project for similar types of concrete surfaces.
2. Provide material and bracing with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.

C. Concealed Concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber that is dressed on at least 2 edges and 1 side. "Concealed" means not visible in the completed structure. (Painted concrete is not to be considered "concealed".)

D. Form Ties:
1. Provide snap ties with plastic cones of same size and shape and of same manufacturer as cement cone hole plugs provided under Concrete Section.
2. Wire ties and site fabricated ties and wood separators are not acceptable.

E. Form Coatings: Commercial formulation resin-based form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatment of concrete surfaces requiring bond, or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds. Oils and petroleum distillates are not acceptable. Verify compatibility of form coating with proposed surface finish.

F. Metal Inserts: Provide metal inserts for anchorage of materials or equipment to concrete construction, where not supplied by other trades and required for the work.

G. Earth forms permitted for footings.

2.2 FORMWORK SYSTEMS

A. Design, erect, support, brace and maintain formwork so that it will safely support vertical and lateral loads that might be applied, until such loads can be supported by the concrete structure. Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation and position.

B. Design forms to include assumed values of live load, dead load, weight of moving equipment operated on formwork, concrete mix, height of concrete drop, vibrator

frequency, ambient temperature, foundation pressures, stresses, lateral stability, and other factors pertinent to safety of structuring during construction.

C. Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.

D. Provide formwork sufficiently tight to prevent leakage of cement past during concrete placement. Solidly butt and gasket joints and provide backup material at joints to prevent leakage and fins.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine surfaces and conditions receiving or affecting the work. Do not proceed until unsuitable conditions have been corrected.

3.2 FORM CONSTRUCTION

A. General: Construct forms complying with ACI 347 and ACI 303R, as applicable to the sizes, shapes, lines and dimensions shown, and to accurate alignment, location, grades, levels, and plumbness. Provide for openings, sleeves, offsets, recesses, reglets, chamfers, inserts, and other features required. Use selected materials to obtain required finishes. Before placing concrete, check the lines and levels of erected formwork. Make corrections and adjustments to ensure proper size and location of concrete members and stability of forming system.

B. Ties:
1. Spacing: Space ties in a uniform pattern satisfactory to the Architect. Rest cones firmly against forms and seal to prevent leakage.

C. Corner Treatment:
1. Make all corners chamfered.
2. Form chamfers with 3/4" x 3/4" strips, unless otherwise shown, accurately formed and surfaced to produce uniformly straight lines and tight edge joints. Extent terminal edges to required limit and miter chamfer strips at changes in direction.
3. Concealed corners may be formed either square or chamfered.

D. Provision for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Size and location of openings, recesses and chases are the responsibility of the trade requiring such items. Accurately place and securely support items built into forms. Openings for doors and windows shall be formed with a tolerance of minus 0" and plus 1/2" from indicated dimensions.

E. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is to be placed. Retighten forms immediately after concrete placement as required to eliminate mortar leaks.

F. Earth Forms:
1. Construct wood edge strips at top sides of excavations.
2. Provide forms for footings wherever concrete cannot be placed against solid earth excavation.
3. Remove loose dirt and debris prior to concrete pours.
4. Foundation concrete may be placed directly into neat excavations provided the foundation trench walls are stable as determined by the Geotecthnical Engineer.
   a. The horizontal dimensions of unformed concrete footings shall be increased 1 inch at every surface at which concrete is placed directly against the soil.
   b. The minimum formwork shown on the drawings is mandatory to ensure clean excavations immediately prior to and during the placing of concrete.

G. Footings and Grade Beams:
1. Provide forms for footings and grade beams if soil or other conditions are such that earth trench forms are unsuitable.

H. For slabs-on-grade, secure edge forms in such a manner as to not move under weight of construction loads, construction and finishing equipment, or workers

3.3 INSTALLATION OF EMBEDDED ITEMS

A. General: Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by, concrete. Use top and bottom templates, setting drawings, diagrams, instructions and directions provided by suppliers of the items to be attached thereto.

B. Coordinate and schedule the work of this Section with the work of other Sections required to be set in, on, or contiguous with forms.

C. Anchor bolts out of position or plumb by more than 1/4" shall be reinstalled in correct position and plumb at no increase in Contract Price.

3.5 REMOVAL OF FORMS

A. Remove forms completely. Exposed surfaces of concrete shall be clean, smooth and free of irregularities.

B. Form Ties:
1. Do not remove ties until concrete has hardened sufficiently to permit removal without damaging concrete. Do not spall concrete on exposed surfaces. Pull ties of type that are wholly withdrawn from the wall toward the inside face. Cutting ties back from face of wall will not be permitted. Plug tie rod holes as specified in Concrete Section.

C. Do not pry against face of concrete. Use wooden wedges only.

D. Forms:

1. Remove forms in manner to ensure safety of members. Do not disturb supporting forms until concrete has hardened sufficiently to permit removal with safety and without damage to concrete surface. Construct forms to permit their removal without disturbing the original shoring.
2. Time of Removal: Time of removal will depend on weather conditions, the results of cylinder tests and effectiveness of curing. The following periods between depositing of concrete and removal of forms shall be considered a minimum, which may be extended if deemed necessary by the Architect. Subject to the requirements of paragraph A above, forms for walls may be removed after 8 hours of completing concrete placement.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Reinforcing steel bars for cast-in-place concrete, complete with tie wire.

B. Support chairs, bolsters, bars supports, spacers, and other accessories for reinforcing.

1.2 RELATED SECTIONS

A. Section 03 10 00: Concrete Formwork.

B. Section 03 30 00: Cast-in-Place Concrete.

1.3 QUALITY ASSURANCE

A. Perform concrete reinforcing work in accordance with CRSI 63 and 65 and ACI 301, 315 and 318, unless specified otherwise in this Section.

B. The Owner's Testing Agency will:

1. Provide tests in accordance with the California Building Code (CBC) Section 1913A.2.
2. Collect mill test reports for reinforcement.
3. Take samples from bundles at fabricators:
   a. When bundles are indentified by the heat number and accompanied by mill analysis, two specimens shall be taken from each ten (10) tons, or fraction thereof, of each size and grade.
   b. When reinforcement is not positively identified by the heat numbers or when random sampling is intended, two specimens shall be taken from each 2-1/2 tons, or thereof, of each size and grade.
   c. All costs associated with the test of reinforcing that not have mill test reports will be at the contractor's expense.
4. Test for tensile and bending strengths.

1.4 REFERENCES

A. California Code of Regulations. Title 24, 2022 edition, also known as California Building Code (CBC) with DSA Amendments.

B. ACI 301 - American Concrete Institute - Specification for Structural Concrete for Buildings.

C. ACI 315 - American Concrete Institute - Details and Detailing of Concrete Reinforcement.

D. ACI 318 - Building Code Requirements for Reinforced Concrete.

E. CRSI 63 - Recommended Practice for Placing Reinforcing Bars.

F. CRSI 65 - Recommended Practice for Placing Bar Supports, Specifications and Nomenclature.

1.5 SUBMITTALS

A. Submit shop drawings including appropriate plans and details. Indicate bar sizes, spacings, locations, and quantities of reinforcing steel, bending and cutting schedules, and supporting and spacing device.

PART 2 - PRODUCTS

2.1 REINFORCING

A. Reinforcing Steel: 60 ksi yield grade; deformed type as indicated on drawings.
1. Bars: Billet steel, ASTM 615; as indicated.
2. Finish: Plain unless indicated galvanized on drawings or so specified.

2.2 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16-gage annealed type, or patented system accepted by Architect.

B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcing during construction conditions.

2.3 FABRICATION

A. Fabricate concrete reinforcing in accordance with ACI 315.

B. Locate reinforcing splices, not indicated on drawings, at points of minimum stress. Location of splices shall be reviewed by Architect.

PART 3 - EXECUTION

3.1 PLACEMENT

A. Place reinforcing supported and secured against displacement. Do not deviate from true alignment.

B. Place reinforcing to obtain at least minimum coverages for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcing in position during concrete placement operations.

C. Before placing concrete, ensure reinforcing is clean, free of loose scale, dirt, or other foreign coatings, which would reduce bond to concrete.

3.2 FIELD QUALITY CONTROL

A. General: The Owner's Testing Laboratory shall test and inspect concrete reinforcement and embedded assemblies as Work progresses. Failure to detect any defective work or material shall not in any way prevent later rejection when such defect is discovered nor shall it obligate the Design Professionals for final acceptance.

B. Owner's Testing Laboratory shall provide qualified personnel at site to inspect reinforcement and embeds using the latest Drawings and reviewed shop drawings, as follows:

1. Prior to placement, inspect reinforcement and embeds for grade, quality of material, absence of foreign matter, and for suitable storage.

2. Provide continuous inspection of reinforcement and embedded assemblies during placement and immediately prior to concreting operations for: size, quantity, vertical and horizontal spacing and location, correctness of bends and splices, mechanical splices, clearances, compliance with specified tolerances, security of supports and ties, concrete cover, and absence of foreign matter.

3. Inspect epoxy-coated reinforcement for coating damage and required applied coatings.

C. Owner's Testing Laboratory shall submit inspection, observation, and/or test reports to the Design Professionals as required herein and shall provide an evaluation statement in each report stating whether or not concrete reinforcement and embedded assemblies conforms to requirements of Specifications and Drawings and shall specifically note deviations there from.

D. Immediately report deficiencies to the Contractor. Contractor shall prepare proposed remedy for deficiency. Contractor shall present proposal to the Design Professionals for approval. After an approved proposal is accepted by the Design Professionals, the Contractor shall correct the deficiency at no cost to the Owner.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Cast-in-place concrete footings, foundations and grade beams.

B. Cast-in-place walls.

C. Floors and slabs on grade.

D. Cast-in-place equipment pads.

E. Surface finish of floors and walls.

F. Preparation of concrete base slabs to receive toppings.

1.2 RELATED WORK

A. Section 03 10 00: Concrete Formwork.

B. Section 03 20 00: Concrete Reinforcement.

C. Mechanical and electrical items to be cast in concrete.

1.3 QUALITY ASSURANCE

A. Perform cast-in-place concrete work in accordance with ACI 318, unless specified otherwise in this Section.

B. Inspection and testing will be performed by owner's testing laboratory.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 00: Submittal Procedures.

C. Submit proposed mix design of each class of concrete to inspection and testing firm and Architect and Engineer for review prior to commencement of work.

D. Three concrete test cylinders will be taken not less than once for every 50 cubic yards of concrete placed or not less than once a day for each class of concrete placed by special inspector.

E. The cement supplier shall submit certification of compliance in accordance with CBC Section 1913A.1.

F.One additional test cylinder will be taken during cold weather concreting, and be cured on

job site under same conditions as concrete it represents.

G. One slump test will be taken for each set of test cylinders taken.

H. The manufacturer of transit-mix concrete shall deliver to job inspector a certificate with each mixer truck. Certificate shall bear signature of representative of Testing Laboratory, stating quantity of cement, water, fine aggregate, coarse aggregate, and admixtures contained in load. Certificates shall indicate time, to the nearest minute, that batch was mixed.

1.5 REFERENCES

A. American Concrete Institute (ACI):

1. ACI 318 - Building Code Requirements for Reinforced Concrete
2. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing concrete.
3. ACI 301 - Specifications for Structural Concrete for Buildings.
4. ACI 305 - Hot Weather Concreting.
5. ACI 306 - Cold Weather Concreting.

B. All work shall be done in accordance with California Code of Regulations. Title 24, 2022 edition, also known as California Building Code (CBC).

PART 2 – PRODUCTS

2.1 CONCRETE MATERIALS

A. Cement: Portland, Type II; ASTM C150. Gray, except where noted, supplement with the following:

1. Fly Ash: 25 percent maximum; Fly Ash shall conform to ASTM C618 Class N or F.
2. Combined Fly Ash and Pozzolan: 25 percent maximum
3. Ground Granulated Blast Furnace Slag: 50 percent maximum
4. Combined Fly Ash or Pozzolan and Ground Granulated Blast Furnace Slag: 50 percent maximum with combined Fly Ash and Pozzolans not exceeding 25 percent

B. Fine and Coarse Aggregates: ASTM C33 for normal weight concrete. Aggregate shall be from established sources with proven history of successful use in producing concrete with minimum shrinkage. The average drying shrinkage after 28 days shall not exceed 0.045 percent for hardrock concrete.

C. Water: Clean, and free from injurious amounts of oil, alkali, organic matter, or other deleterious material.

D. Source of aggregate shall remain constant for the duration of the work, as practical.

2.2 ADMIXTURES

A. Air Entrainment: ASTM C260.

B. Water-Reducing Admixture: ASTM C494, Type A, and containing not more than 0.1 percent chloride ions.

C. Water-Reducing, Retarding Admixture: ASTM C494, Type D, and containing not more than 0.1 percent chloride ions.

D. Pozzolan: ASTM A618, containing not more than 0.1 percent chloride ions.

E. Calcium Chloride: Not permitted.

F. ASTM C 494, Type C, 30% + 2% solution of Calcium Nitrite

2.3 ACCESSORIES

A. Bonding Agent: "Anvil Bond" as manufactured by Master Builders or approved equal.

B. Non-Shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2400 psi in two days and 6000 psi in 28 days.

C. Absorptive Mats: Cotton fabric or burlap-polyethylene, minimum 8oz./sq. yd; bonded to prevent separation during handling, placement and curing.

D. Liquid Membrane-Forming curing Compound: Conforming to ASTM C309, Type I, and which will not discolor concrete or affect bonding or other finish applied thereover, and which restricts loss of water to not more than 0.500 grams per sq. cm. of surface when tested per ASTM C156.

E. Provide Fly Ash or other reclaimed cementitious materials as indicated in Section 2.01.A.

F. Slab-Leveling Compound. Provide leveling compound where required to meet floor flatness and levelness requirements. Acceptable products include Ardex SD-L, Burke 300 Durock or approved equal.

2.4 PROPORTIONING AND DESIGN OF MIXES

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method used, use an independent testing facility acceptable to Engineer and Architect for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing unless otherwise acceptable to Architect.

B. Except as otherwise specified, submit written reports to Architect and Engineer of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by Architect and Engineer.

C. Unless lower limits are stated in the contract documents, all concrete exposed to freezing and thawing in moist condition and/or required to be watertight or used in slabs-on-grade shall have a maximum W/cm ratio of 0.45.

D. Provide concrete of following strength:
   1. Compressive strength (28 day) shall be as shown on Structural Drawings.
   2. Select proportions for normal weight concrete in accordance with ACI 301 by Method 1, 2 or 3 as applicable. Add air-entraining agent to concrete to entrain air as indicated in ACI 301.

E. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, water, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by architect before using in work.

F. Admixtures:
   1. Use water-reducing admixture or high-range, water-reducing admixture (super plasticizer), may be used in concrete subject to approval by Architect.
   2. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50 degrees F (10 degrees C).
   3. Use air-entraining admixture in exterior exposed concrete, unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having air content of 4 percent to 6 percent.

2.5 CONCRETE MIXES

A. Ready-Mix Concrete: All concrete shall be ready-mix concrete unless otherwise approved by the Engineer and Architect.

B. Self-Leveling Concrete Topping - Underlayment for Interior Applications:

   1. Topping for epoxy terrazzo flooring application shall include latex modifier, such as “TERA-GEM III, Revocoat Latex #1 Additive”. Follow manufacturer’s recommendations and flooring installation requirements.
   2. Use self-leveling underlayment concrete formulated to level concrete floors without shrinking, cracking or spalling, and capable of being placed from feathered edge to 1" thickness without aggregate in one pour. If greater than 1" thickness is required, aggregate shall be used in accordance with manufacturer's requirements. Appropriate primer shall be utilized for all underlayment applications.
   3. Example acceptable product: Ardex Engineered Cements "ARDEX K-15"
   4. Example acceptable product: Euclid Chemical’s “Flo-Top or Super Flo-Top”
   5. Example acceptable product: Sika Corporation “Sika Level Series”
   6. Example acceptable product: BASF “MasterTop 110SL”

PART 3 - EXECUTION

3.1 PLACING CONCRETE

A. Pre-placement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.

B. Place concrete in accordance with ACI 304, and as herein specified.

C. Notify Structural Engineer minimum 48 hours prior to placing of concrete.

D. Ensure anchors, seats, plates, and other items to be cast into concrete are placed, held securely, and will not cause problems in placing concrete. Rectify misplacements and proceed with work.

E. Maintain records of poured concrete items. Record date, location of pour, quantity, air temperature and test samples taken.

F. Ensure reinforcement, embedded parts, formed expansion and contraction joints, and other inserts are not disturbed during concrete placement.

G. Prepare previously placed concrete by blowing joints and provide keyway.

H. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified only with prior approval of the Architect. Deposit concrete as nearly as practicable to this final location to avoid aggregation.

I. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

J. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.

K. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

L. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

M. Bring slab surfaces to correct level with straight-edge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

N. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Engineer and Architect immediately on discovery.

O. Conform to ACI 305 when concreting during hot weather.

P. Conform to ACI 306 when concreting during cold weather.

Q. Unless otherwise permitted, time for completion of discharge shall comply with ASTM C94/C94M. When discharge is permitted after more than 90 minutes have elapsed since batching or after the drum has revolved 300 revolutions, verify that air content of air-entrained concrete, slump, and temperature of concrete are as specified. When discharge is permitted after more than 90 minutes have elapsed since batching or after the drum has revolved 300 revolutions, no water may be added.

3.2 FINISH OF FORMED SURFACES

A. Rough Form Finish: For all formed concrete surfaces except as noted below. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projects exceeding 1/4" in height rubbed down or chipped off.

B. Smooth Form Finish: For formed concrete surfaced exposed-to-view or to be covered with a material such as waterproofing that requires a smooth surface. This is as cast arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas, with fins or other projects completely removed and smoothed.

3.03 MONOLITHIC SLAB FINISHES

A. General: finish slab surfaces in accordance with one of the finishes noted below, as designated in the Contract Documents. Finish all joints and edges with proper tools as approved.

B. Placement: Place concrete at rate that allows spreading, straight-edging, and darbying or bull floating before bleed water appears. Screed all slabs, topping fills to true levels and slopes. Work surfaces as required to produce specified finish. Do no finishing in areas where water has accumulated; drain and re-screed. In no case use a sprinkling of cement and sand to absorb moisture.

C. Tolerances: Measure slabs-on-grade to verify compliance with the tolerance requirements of ASTM E 1155 and ACI 117. Measure floor finish tolerances within 72 hours after slab finishing and before removed of supporting formwork or shoring.
   1. Concrete slab flatness and levelness tolerances to meet ACI 117, Section 4.5.6.
      a. Minimum requirements at slab-on-ground: Flatness overall min Ff = 20 and levelness overall min Fl = 17.

D. Scratch Finish:

   1. Apply scratch finish to monolithic slab surfaces that are to receive mortar setting beds for tile, where mortar set tile is indicated on drawings.
   2. After placing slabs, plane surface to a tolerance not exceeding ¼” in 10’ when tested with a 10’ straightedge. Slop surfaces uniformly to drains where required. After leveling, roughen surface before final set, with staff brushes, brooms, or rakes.

E. Float Finish:

   1. Apply float finish to monolithic slab surfaces scheduled to receive trowel finish and other finishes as hereinafter specified.

2. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Check and level surface plane to a tolerance not exceeding 1/4" in 10' when tested with a 10' straightedge. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, re-float surfaces to a uniform, smooth, granular texture.

F. Trowel Finish:

1. Unless otherwise noted, apply trowel finish to monolithic slab surfaces to be left exposed-to-view, or scheduled to receive floor finishes other than setting bed types.
2. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding those called out above in section C. Grind smooth surface defects, which would telegraph through applied floor covering system.

G. Non-Slip Broom Finish:

1. Apply non-slip broom finish to exterior concrete platforms, steps and ramps, and elsewhere as indicated.
2. Immediately after trowel finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.4 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
   1. Start curing procedures as soon as free water has disappeared from concrete surface after placing and finishing.
   2. Continue curing as directed by Architect and in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

B. Curing Methods: Perform curing of concrete by either moist curing, by moisture retaining cover curing, membrane curing, or by combinations thereof, as herein specified.
   1. Provide moisture curing by following methods:
      a. Keep concrete surface continuously wet by covering with water.
      b. Continuous water-fog spray.
      c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4-inch lap over adjacent absorptive covers.
   2. Provide moisture-cover curing as follows: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed at widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Provide liquid membrane curing as follows:
   a. Apply the specified membrane-forming curing compound to damp concrete surfaces as soon as possible after final finishing operations are complete, but not later than 2 hours. Apply uniformly in a continuous operation by power spray equipment or roller equipment in accordance with the manufacturer's directions. Recoat areas that are subjected to heavy rainfall within three hours after initial application. Maintain the continuity of the coating and repair damage to the coat during the entire curing period.
   b. Verify compatibility of membrane curing compounds on surfaces that are to be covered with a coating material applied directly to the concrete or with a covering material bonded to the concrete, such as other concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring, painting, and other coatings and finish materials, unless otherwise acceptable to the Architect.

   c. Do not use curing compounds that will diminish bond of subsequent materials.

4. Curing Formed surfaces: Cure formed concrete surfaces, including walls with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

5. Curing Unformed surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by any of the methods specified herein, as applicable.

3.5 PATCHING

A. Allow Architect/Structural Engineer to inspect concrete surfaces immediately upon removal of forms. Patch imperfections as directed.

3.6 FIELD QUALITY CONTROL

A. Contractors Testing Laboratory: As specified in Article 1.03 above.

3.7 DEFECTIVE CONCRETE

A. Modify or replace concrete not conforming to required lines, details, and elevations.

B. Repair or replace concrete not properly placed resulting in excessive honeycombing and other defects. Patch, fill, touch up, repair, or replace exposed architectural concrete for each individual area in accordance with Architect’s particular directions.

END OF SECTION

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Stainless steel railings.

1.3 COORDINATION

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

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

C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Manufacturer's product lines of mechanically connected railings.
2. Fasteners.
3. Post-installed anchors.
4. Handrail brackets.
5. Shop primer.
6. Intermediate coats and topcoats.
7. Bituminous paint.
8. Nonshrink, nonmetallic grout.
9. Anchoring cement.
10. Metal finishes.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Initial Selection: For products involving selection of color, texture, or design, including mechanical finishes.

D. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters, including finish.
2. Fittings and brackets.
3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.

a. Show method of connecting and finishing members at intersections.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For delegated-design professional engineer.

B. Welding certificates.

1.6 QUALITY ASSURANCE

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

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

B. Comply with most current edition of California Building Code (CBC)

1. CBC Chapter 10 – Means of Egress
2. CBC Chapter 11B – Accessibility to Public Buildings, Public Accommodations, Commercial Facilities and Publicly Funded Housing
3. CBC 16A – Structural Design
4. CBC 22A – Steel

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces of railings from damage by applying a strippable, temporary protective covering before shipping.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication.

1. Provide allowance for trimming and fitting on site.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
b. Infill load and other loads need not be assumed to act concurrently.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

1. Provide type of bracket as indicated and that provides 1-1/2-inch (38-mm) clearance from inside face of handrail to finished wall surface.

2.3 STAINLESS STEEL RAILINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Julius Blum & Co., Inc.
2. Stainless Fabricators, Inc.
3. Wagner Companies (The); R&B Wagner, Inc.

B. Source Limitations: Obtain each type of railing from single source from single manufacturer.

A. Pipe: ASTM A312/A312M, Grade TP 304.

B. Castings: ASTM A743/A743M, Grade CF 8 or CF 20.

C. Plate and Sheet: ASTM A240/A240M or ASTM A666, Type 304.

2.4 FASTENERS

A. Fastener Materials:

1. Ungalvanized-Steel Railing Components: Plated steel fasteners complying with ASTM F1941 (ASTM F1941M), Class Fe/Zn 5 for zinc coating.
2. Stainless Steel Railing Components: Type 304 stainless steel fasteners.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction.

C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
2. Provide tamper-resistant square or hex socket flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Anchors: Provide cast-in-place or torque-controlled expansion anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

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

2.5 MISCELLANEOUS MATERIALS

A. Handrail Brackets: Cast stainless steel, center of handrail. See drawings for dimension of bracket from [wall] [railing].

B. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.

1. For stainless steel railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

C. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

D. Bituminous Paint: Cold-applied asphalt emulsion, complying with ASTM D1187/D1187M.

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

F. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. Water-Resistant Product: At exterior locations and where indicated on Drawings, provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.

1. Clearly mark units for reassembly and coordinated installation.
2. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that are exposed to weather in a manner that excludes water.

1. Provide weep holes where water may accumulate.
2. Locate weep holes in inconspicuous locations.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

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 flux immediately.
4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 welds; ornamental quality with no evidence of a welded joint

I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection, using an epoxy structural adhesive, if this is manufacturer's standard splicing method.

J. Form changes in direction as follows:

1. By flush bends or by inserting prefabricated flush-elbow fittings.

K. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.

L. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.

M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

N. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work.

1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
2. Coordinate anchorage devices with supporting structure.

O. For railing posts set in concrete, provide stainless steel sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with metal plate forming bottom closure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Perform cutting, drilling, and fitting required for installing railings.

1. Fit exposed connections together to form tight, hairline joints.
2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

C. Adjust railings before anchoring to ensure matching alignment at abutting joints.

D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws, using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article, whether welding is performed in the shop or in the field.

3.4 ANCHORING POSTS

A. Use stainless steel pipe sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Form or core-drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

C. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.

D. Anchor posts to metal surfaces with flanges, angle type, or floor type, as required by conditions, connected to posts and to metal supporting members as follows:

1. For steel railings, weld flanges to post and bolt to metal supporting surfaces.

3.5 CLEANING

A. Clean aluminum and stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.

3.6 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period, so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 055213

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section Includes: Provision of all lumber framing, rough hardware, blocking and backing as indicated in the contract drawings.

1.2 REFERENCES

A. Requirements of GENERAL CONDITIONS and DIVISION NO. 1 apply to all Work in this Section.

B. The following published specifications, standards, tests, or recommended methods of trade, industry, or governmental organizations apply to Work in this Section (latest editions apply).

1. California Code of Regulations. Title 24, 2022 edition, also known as California Building Code (CBC).

2. (APA) - American Plywood Association, “Guide to Plywood Grades.”

3. (PS) - United States Product Standard, PS-1 and PS-2 “Construction and Industrial Plywood.”

4. (UL) - Underwriters’ Laboratories, Inc., “Fire Hazard Classification, FR-S.”

5. (WCLIB) - West Coast Lumber Inspection Bureau, “Standard Grading Rules No. 17.”

6. (WWPA) - Western Wood Products Association, “Grading Rules for Lumber.”

7. (AWPA) - American Wood Preservers Association Standards.

a. T1 – “Processing and Treatment Standard”

b. U1 – “User Specification for Treated Wood”

8. (AF&PA) - American Forest and Paper Association, “National Design Specification for Wood Construction.” “Special Design Provisions for Wood & Seismic.”.

9. (ASTM) - American Society of Testing and Materials.

1.3 SUBMITTALS

A. Shop Drawings of all specially fabricated rough hardware.

B. Certification: Provide lumber with each piece factory-marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mil.

C. Samples as requested by the architect.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Provide proper facilities for handling and storage of materials to prevent damage to edges, ends, and surfaces.

B. Keep materials under cover and dry. Protect against exposure to moisture and contact with damp or wet surfaces. Where necessary, stack materials off ground on level flat forms, fully protected from weather.

1.5 JOB CONDITIONS

A. Environmental Requirements: Maintain uniform moisture content of lumber at not more than 19-percent during and after installation.

B. New lumber adjacent and connected to existing lumber shall have a moisture content of not more than 15 percent at the time of installation.

C. Sequencing, Scheduling: Coordinate details with other Work supporting, adjoining or fastening to rough carpentry Work.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Rough Carpentry:

1. Sills on Concrete: Douglas Fir with Preservative Treatment.

2. Lumber (Wood Framing): Meet requirements of following minimum grades.

Item	
Studs	D.F. No. 1
Plates	D.F. No. 1
Beams	D.F. No. 1
Joists	D.F. No. 1
Posts	D.F. No. 1
Blocking	D.F. No. 2

3. Plywood: Provide thickness, grade, and panel identification index shown on drawings. For plywood thickness 5/32 or greater provide a minimum of 5 ply.

B. Rough Hardware: All exterior hardware shall be hot-dipped galvanized.

1. Nails: Common wire per ASTM F1667, typical; hot-dipped zinc-coated galvanized, stainless steel, silicon bronze, or copper at exposed conditions, fire-retardant-treated, and preservative-treated lumber.

2. Expansion Bolts: Reverse cone, self-wedging, expansion type, Tightening of nut or increased tension on bolt shank shall act to force wedges outward to create positive increased resistance to withdrawal, Simpson Strong-Bolt, Hilti Kwik-Bolt TZ, or equal product substituted per Section 01 63 00.

3. Metal Framing Connectors: Fabricate from hot-dipped galvanized steel (G90 coating). Connectors in contact with preservative-treated lumber shall have G185 hot dipped galvanized coating per ASTM A653. Connectors in contact with fire-treated lumber or are in high corrosive environments shall be manufactured with Type 316L stainless steel. Connectors shall be at least 16-gauge material, 1/8-inch plate materials where welded, unless otherwise shown or specified, punched for nailing. Nails and nailing shall conform to the manufacturer's instructions, including coating and material where applicable, with a nail provided for each punched nail hole. Use maximum nail size listed by manufacturer. Manufactured by Simpson Company or equal product substituted per Section 01 63 00.

4. Miscellaneous Hardware: Provide all common screws, bolts, fastenings, washers and nuts required to complete rough carpentry Work.

5. Bolts and sill bolts in wood shall be ASTM A307 with standard cut threads; full diameter bolts (no rolled or "upset" threads permitted) per ANSI/ASME standard B18.2.1.

6. Fasteners used for attachment of exterior wall coverings shall be hot-dipped zinc-coated galvanized steel, mechanically deposited zinc-coated steel, stainless steel, silicon bronze, or copper. The coating weights for hot-dipped zinc-coated fasteners shall be in accordance with ASTM A153. The coating weights for mechanically deposited zinc-coated fasteners shall be in accordance with ASTM B695, Class 55 minimum.

2.2 TREATMENTS

A. Fire-Retardant Treatment: Furnish in accordance with AWPA Standards T1, U1, and P17, "Fire Retardant Formulations."

B. Preservative Treatment: Furnish in accordance with AWPA Standards T1 and U1. Preservatives with an ammonia base, including Ammoniacal Copper Zinc Arsenate (ACZA) are not permitted.

2.3 FABRICATION

A. Preparation:

1. Verify measurements at job site.

2. Verify details and dimensions of equipment and fixtures integral with finish carpentry for proper fit and accurate alignment.

3. Coordinate details with other work supporting, adjoining, or fastening to casework.

B. Lumber:

1. Air- or kiln-dry to maximum 19-percent moisture content at time of surfacing.

2. Furnish surfaced four sides, S4S, unless otherwise noted.

3. Size to conform with rules of governing standard. Sizes shown are nominal unless otherwise noted.

C. Wood Treatments:

1. Fire-Retardant Treatment:

a. Treat in accordance with AWPA Standards T1 and U1 and approved manufacturer's recommendations. Verify AWPA Use Category with proposed application prior to selected preservative. Fire treated lumber shall conform to the requirements of CBC Section 2303.2.

2. Preservative Treatment:

a. Treat lumber and plywood sheathing that is:

i. In contact with concrete and masonry less than six feet above the ground.

ii. Exposed to weather permanently.

iii. Where specified in the Contract Documents.

b. Treat in accordance with AWPA Standards T1 and U1. Verify AWPA Use Category with proposed application prior to selecting preservative.

c. Treated lumber shall be marked per CBC Section 2303.1.8.1.

d. After Treatment and prior to shipping, air- or kiln-dry lumber to maximum 19-percent moisture content.

2.4 SOURCE QUALITY CONTROL

A. Lumber shall bear grade-trademark or be accompanied by certificate of compliance of appropriate grading agency.

B. Plywood shall bear APA grade-trademark.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive rough carpentry Work and verify following:

1. Completion of installation of building components to receive rough carpentry Work.

2. That surfaces are satisfactory to receive Work.

3. That spacing, direction, and details of supports are correct to accommodate installation of blocking, backing, stripping, furring and nailers.

4. That all anchor bolts and holdown bolts are properly installed.

3.2 INSTALLATION

A. Cutting: Perform all cutting, boring, and similar Work required.

B. Selection of lumber pieces:

1. Carefully select all members. Select individual pieces so that knots and defects will not interfere with placement of bolts, with nailing or making connections.

2. Cut-out and discard pieces with defects that make the piece unable to serve its intended function. The Architect may reject lumber, whether or not it has been installed, for excessive warp, twist, bow, crook, mildew, fungus or mold as well as for improper cutting or fitting.

3. Shimming: Do not shim sills, joists, short studs, trimmers, headers, lintels and other framing members unless specifically detailed in drawings.

C. Drill holes in pieces where splitting may occur.

1. Remove split lumber and replace with new members.

2. Fasten framing anchors and steel bridging with galvanized special nails furnished with hardware in every nail hole, except where noted to be welded to structural steel supports in which case comply with AWS requirements.

D. Studs, Joists, Beams, and Posts: Install all members true to line. No wood shingle shims are permitted. Place joists with crown up; maximum 1/4-inch crown permitted.

E. Nail joints in accordance with applicable requirements of the CBC Table 2304.9.1 unless otherwise shown or specified. Predrill where nails tend to split wood. Nails into preservative-treated lumber shall be hot-dipped galvanized.

F. Bolt holes to be 1/16-inch oversize. Threads shall not bear on wood. Use standard malleable iron washers against wood. Carriage bolts require washers under the nut only.

G. Provide blocking, grounds, nailers, stripping, and backing as shown and as required to secure other Work.

H. Adjoining sheathing panel edges shall bear and be attached to the framing members. Nails shall be placed not less than 3/8-inch from the panel edge.

I. Plywood flooring shall be field glued with adhesive meeting APA specification AFG-01 applied in accordance with the manufacturer's recommendations. Apply continuous line of glue on joists and in groove of tongue and groove panels.

J. Protect preservative-treated and fire-treated lumber per APWA Standard M4, "Standard for the Care of Preservative-Treated Wood Products."

K. Where wood is cut, sawed, planed, bored or marred after preservative or fire-retardant treatment, apply two heavy brush coats of same material used in treatment.

L. Nail heads shall be driven flush with plywood surface. Overdriven nails (nails which fracture the outer ply layer) shall be replaced one for one.

M. Screws (Wood or Lag): Screws shall be screwed and not driven into place. Screw holes for the unthreaded portion shall be predrilled to the same diameter and depth of shank. Holes for threaded portion shall be predrilled less than or equal to the diameter of the root of the thread. Provide standard cut washers under head of lag screws.

N. Sheathing used for diaphragms and shear walls that are part of the seismic-force-resisting system shall be applied directly to framing members. Sheathing is permitted to be fastened over solid limber planking or laminated decking, provided the sheathing panel joints do not align with the planking or decking joints.

3.3 CLEANING AND ADJUSTING EXPOSED TIMBER

A. Remove damaged or otherwise disfigured portions and replace with new prior to the Owner's acceptance.

B. Wash finished Work in strict accordance with product manufacturer's directions and ensure that washed surfaces do not differ from clean unwashed surfaces. Any difference will be considered unsatisfactory work.

3.4 FIELD QUALITY CONTROL

A. The Owner's Testing Agency shall:

1. Inspect erected timber framing as required to establish conformity of work with Drawings.

2. Inspect all timber connectors per CBC Section 1704A.5.3.

3. Inspect high-load diaphragm nailing and support framing per CBC Section 1704A.5.1.

4. Inspect elements of the seismic lateral force resisting system per CBC Section 1705A.11.

   a. Inspect floor and roof diaphragm nailing for nail size, spacing and penetration at plywood panel edges, and special nailing at collector and drag members.

   b. Inspect shear wall nailing for nail size, spacing, edge distance and penetration at plywood panel edges, and nailing at holdown posts.

   c. Inspect all bolted connections of elements that are part of the seismic lateral force resisting system.

   d. Inspect holdown bolts into wood and concrete.

B. Machine Nailing: Use of machine nailing is subject to a satisfactory jobsite demonstration for each project and the approval of the Project Inspector and the Structural Engineer. The approval is subject to continued satisfactory performance. If the nail heads penetrate the outer ply more than would be normal for a hand-held hammer, or if minimum allowable edge distances are not maintained, the performance will be deemed unsatisfactory and machine nailing shall be discontinued.

3.5 CLEAN-UP

A. Dispose of pressure-treated wood in an authorized disposal area. DO NOT BURN TREATED WOOD. Do not bury wood of any type on the jobsite.

END OF SECTION

SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Interior standing and running trim.
2. Wood furring, blocking, shims, and hanging strips for installing interior architectural woodwork items that are not concealed within other construction.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing interior architectural woodwork that are concealed within other construction before interior architectural woodwork installation.

1.3 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections, to ensure that interior architectural woodwork can be supported and installed as indicated.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Anchors.
2. Adhesives.

B. Shop Drawings:

1. Include the following:

a. Dimensioned plans, elevations, and sections.
b. Attachment details.

2. Show large-scale details.

3. Show locations and sizes of furring, blocking, and hanging strips, including blocking and reinforcement concealed by construction and specified in other Sections.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For architectural woodwork manufacturer.

B. Product Certificates: For the following:

1. Composite wood products.
2. Adhesives.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with the Architectural Woodwork Standards, Section 2.

B. Do not deliver interior architectural woodwork until painting and similar finish operations that might damage woodwork have been completed in installation areas.

C. Store woodwork in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1. Handle and store fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions.

1.8 FIELD CONDITIONS

A. Environmental Limitations without Humidity Control: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of the construction period.

B. Field Measurements: Where interior architectural woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being concealed by construction, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where interior architectural woodwork is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.9 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL WOODWORK, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

2.2 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

A. Architectural Woodwork Standards Grade: Custom.

B. Softwood Lumber:

1. Wood Species and Cut: Match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building unless otherwise indicated.
2. Grade: Clear All Heard Redwood where indicated. Manufactured to sizes and patterns shown
3. Cut: Plain sawn.
4. Wood Moisture Content: 5 to 10 percent.
5. Provide split species on trim that faces areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.
6. For trim items other than base wider than available lumber, use veneered construction. Do not glue for width.
7. For base wider than available lumber, glue for width. Do not use veneered construction.
8. For rails thicker than available lumber, use veneered construction. Do not glue for thickness.
9. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches (76 mm) wide.

2.3 HARDWOOD SHEET MATERIALS

A. Composite Wood Products: Provide materials that comply with requirements of the Architectural Woodwork Standards for each type of interior architectural woodwork and quality grade specified unless otherwise indicated.

1. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.

a. Plain sawn, book matched, medium density fiberboard core.
b. Front face Grade AA
c. Back face Grade 1
d. Glue type as recommended for application

2.4 FABRICATION

A. Fabricate interior architectural woodwork to dimensions, profiles, and details indicated.

1. Ease edges to radius indicated for the following:

a. Edges of Solid-Wood (Lumber) Members: 1/16 inch (1.5 mm) unless otherwise indicated.

B. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site.

1. Disassemble components only as necessary for shipment and installation.
2. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.
3. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled.

a. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting.
b. Verify that parts fit as intended, and check measurements of assemblies against field measurements indicated on approved Shop Drawings before disassembling for shipment.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition interior architectural woodwork to humidity conditions in installation areas for not less than 72 hours prior to beginning of installation.

B. Before installing interior architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming of concealed surfaces.

3.2 INSTALLATION

A. Grade: Install interior architectural woodwork to comply with same grade as item to be installed.

B. Assemble interior architectural woodwork and complete fabrication at Project site to the extent that it was not completed during shop fabrication.

C. Install interior architectural woodwork level, plumb, true in line, and without distortion.

1. Shim as required with concealed shims.
2. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

D. Scribe and cut interior architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor interior architectural woodwork to anchors or blocking built in or directly attached to substrates.

1. Secure with countersunk, concealed fasteners and blind nailing.
2. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with interior architectural woodwork.
3. For shop-finished items, use filler matching finish of items being installed.

3.3 REPAIR

A. Repair damaged and defective interior architectural woodwork, where possible, to eliminate functional and visual defects and to result in interior architectural woodwork being in compliance with requirements of Architectural Woodwork Standards for the specified grade.

B. Where not possible to repair, replace defective woodwork.

C. Field Finish: See Section 099124 "Interior Painting" for final finishing of installed interior architectural woodwork not indicated to be shop finished.

3.4 CLEANING

A. Clean interior architectural woodwork on exposed and semiexposed surfaces.

END OF SECTION 064023

SECTION 064116 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Plastic-laminate-clad architectural cabinets.

2. Cabinet hardware and accessories.
3. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-clad architectural cabinets that are not concealed within other construction.
4. Solid-surface countertops

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.

1.3 REFERENCES

A. The North American Architectural Woodwork Standards (NAAWS), latest edition. Jointly published by Woodwork Institute and the Architectural Woodwork Manufacturers Association of Canada.

1.4 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's standard specifications for the following:

1. Plastic-laminate countertops with post-industrial recycled content
2. Solid Surface countertops with post-industrial recycled content
3. Cabinet hardware
4. FSC Certified 100% post-industrial recycled particleboard.
5. Greenguard certified adhesives indicating compliance with requirements for low-emitting materials.

B. Sustainable Design Submittals:

1. Laboratory Test Reports: For composite wood products, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings:

1. Indicate casework types, sizes and locations
2. Include plans, elevations, sections, and attachment details.
3. Show large-scale details.
4. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
5. Show tolerances, clearances required and utility connections, if any.
6. Include coordinated information for laboratory equipment specified in another section and/or furnished by Owner.
7. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.

8. Furnish a Woodwork Institute Certified Compliance Label on the first page of the shop drawings.

D. Samples: For each exposed product and for each color and texture specified.

1. Plastic Laminates: 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish required.

a. Provide one sample applied to core material with specified edge material applied to one edge.

2. Solid Surface Countertops: 4 by 4 inches, for each type, color, pattern, and surface finish required.
3. Thermally Fused Laminate (TFL) Panels: 8 by 10 inches (200 by 250 mm), for each color, pattern, and surface finish.

a. Provide edge banding on one edge.

4. Corner Pieces:

a. Cabinet-front frame joints between stiles and rails and at exposed end pieces, 18 inches (450 mm) high by 18 inches (450 mm) wide by 6 inches (150 mm) deep.
b. Miter joints for standing trim.

5. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Certificates: Woodwork Institute Certificates. Certificates shall warrant that the cabinets meet all requirements for Woodwork Institute “Custom Grade”. Submit certificates at project close out.

C. Field quality-control reports.

D. Maintenance Data: Manufacturer’s recommendations for care and cleaning

E. Finish touch-up kit for each type and color of materials provided

1.8 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: WI Certified Compliance Program certificates.

1.9 QUALITY ASSURANCE

A. Verification of compliance with Cal Green requirements for composite wood products shall include documentation of at least one of the following as requested by the enforcing agency:

1. Product certifications and specifications
2. Chain of custody certifications
3. Product labeled and invoiced as meeting the Composite Wood Products regulation (CCR Title 17, Section 93120)

B. Manufacturer's Qualifications:

1. Firm (woodwork manufacturer) with no less than five years of production experience similar to a specific project, whose qualifications indicate the ability to comply with the requirements of this section.
2. The woodwork manufacturer must have at least one project in the pastfive years where the value of the woodwork was within 20 percent of the cost of woodwork for this project.

3. A Woodwork Institute Accredited Millwork Company in good standing.

C. Single Source Responsibility: A single fabricator shall provide and install the work of this section.

D. Work shall be in accordance with Grade or Grades Specified of the “Architectural Woodwork Standards.”

E. Certified Compliance

1. Before delivery to the job site, provide a Woodwork Institute Certified Compliance Certificate indicating the millwork products being supplied and certifying that these products fully meet the requirements of the NAAWS Grade or Grades specified.
2. Provide a Woodwork Institute Certified Compliance Label on each elevation of casework.
3. At completion of installation provide a Woodwork Institute Certified Compliance Certificate indicating the products installed, and certifying that the installation of these products fully meets the requirements of the NAAWS Grade or Grades specified.
4. All fees charged by the Woodwork Institute for its Certified Compliance program are the responsibility of the millwork manufacturer and/or installer and shall be included in their bid.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.11 FIELD CONDITIONS

A. Environmental Limitations without Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.

C. Field Measurements - Retrofit: Where casework is indicated to fit to existing construction, verify dimensions of existing construction by field measurements before fabrication and indicate measurements on Shop Drawings. Provide fillers and scribes if necessary.

D. Field Measurements for Countertops: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete. Coordinate fabrication schedule with construction progress to avoid delaying the Work

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Quality Standard: Unless otherwise indicated, comply with the North American Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.

B. Cabinets: Woodwork Institute "Custom Grade"

1. Provide Woodwork Institute Certification: Each cabinet shall be Woodwork Institute Certified, bearing the "stamp of certification" affixed in a semi-exposed location on each unit and showing compliance with the above standard, when in the sole opinion of the Architect, the quality of the product provided is in question or does not meet the quality standards of the Woodwork Institute's Manual of Millwork. This certification shall be provided on all casework in question at no additional cost to the owner.

C. All casework shall comply with 2022 CBC, Section 11B.

D. Cabinet Design Requirements

1. Woodwork Institute cabinet design series (CDS):

a. Cabinet design requirements are designated on drawings using Woodwork Institute "Cabinet Design Series (CDS)" numbering system.
b. Where individual cabinet design requirements do not fit within the CDS numbering system, cabinet design requirements are detailed on drawings.

1) Catalog Standards:

a) Manufacturer's catalog numbers may be shown on drawings for convenience in identifying certain cabinet design requirements. Unless modified by notation on drawings or otherwise specified, catalog description for indicated number constitutes requirements for each such cabinet.
b) The use of catalog numbers is not intended to preclude the use of any other acceptable manufacturer's products, which are equivalent, but are given for the purpose of establishing design requirements.

2.2 COMPONENTS

A. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.

1. Products: Subject to compliance with requirements, provide the following:

a. Nevamar Corp: High Pressure Laminate with “Armor Protection Plus”
b. Wilsonart LLC; High Pressure Laminate with “High Wear Laminate”

B. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As selected by Architect from laminate manufacturer's full range in the following categories:

a. Solid colors, matte finish.
b. Solid colors with core same color as surface, matte finish.
c. Wood grains, matte finish.
d. Patterns, matte finish.

C. Laminate Cladding for Exposed Surfaces:

1. Horizontal Surfaces: Grade HGS.
2. Postformed Surfaces: Grade HGP.
3. Vertical Surfaces: Grade VGS.
4. Edges: PVC edge banding, 3.0 mm thick, matching laminate in color, pattern, and finish.
5. Pattern Direction: As indicated.

D. Materials for Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS.

a. Edges of Plastic-Laminate Shelves: PVC edge banding, 3.0 mm thick, matching laminate in color, pattern, and finish.
b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade CLS.

2. Drawer Sides and Backs: Thermally fused laminate panels with PVC or polyester edge banding.
3. Drawer Bottoms: Thermally fused laminate panels.

E. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

2.3 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Solid Wood or Plywood: Columbia Forest Products, Purebond Classic Core plywood, with no defects affecting strength or utility. Hardwood and softwood lumber kiln dried to 7 and 10 percent moisture content, respectively.

B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Composite Wood Products: Verify products are made using ultra-low-emitting formaldehyde resins, as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products," (ATCM 17 CCR 93120 et. Seq.) or are made with no added formaldehyde.
2. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130.
3. Particleboard (Medium Density): ANSI A208.1, Grade M-2. 100% post-industrial recycled particleboard.
4. Thermally Fused Laminate (TFL) Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.4 CABINET HARDWARE AND ACCESSORIES

A. General: Color as selected by architect.

B. Butt Hinges: 2-3/4-inch x 3-5/8-inch, five-knuckle steel hinges made from 0.078-inch thick steel with 4 screws each into door, five screws into end panel. Hospital tip, rounded corner knuckles and fixed pins.

1. Semiconcealed Hinges for Flush Doors: ANSI/BHMA A156.9, B01361.

C. Catches: Magnetic catches, heavy duty metal casing, complying with ANSI/BHMA A156.9, B03141

D. Adjustable Shelf Clips: Steel with pins for ¼ inch drilled holes with earthquake pins to hold shelves against lateral movement.

1. Manufacturer: Hettich America, Sekura #6 or approved equal

E. Drawer Slides: ANSI/BHMA A156.9.

1. Manufacturer: Accuride International, or approved equal

2. Heavy-Duty (Grade 1HD-100 and Grade 1HD-200): Side mount. Drawer slides shall be zinc plated, cold rolled steel, full extension, linear ball bearing slides rated at 100 pounds minimum. The drawer shall be removable without the use of tools.

    a. Standard Drawers: Full extension rated at 100 lbs. With positive stops to prevent inadvertent removal.
    b. File Drawers: 3 piece full extension rated at 100 lbs. with positive stops to prevent inadvertent removal.
    c. Paper Storage Drawers or Drawers over 36” wide: 2 piece roller side guides rated at 150 lbs. With positive stops to prevent inadvertent removal.
    d. Motion Feature: Soft close dampener.

F. Drawer Bumper Stops: Adjustable at each side rear to prevent impact on drawer front

G. Pulls: 4” U shaped handles with minimum 2” between face of cabinet and pull for drawers and hinged doors; sliding doors -- Finish as selected by Architect from US32, US32D US28 or from manufacturer’s full list of available colors. U-pulls to comply with 11B-309.4.

H. Locks:

1. Manufacturer: Olympus
2. Multiple cabinet locks all keyed alike. Master key that will open all casework locks on site. 5 pin tumbler. Model #100-26D78-915 (for doors). Model #600DW (for drawers).
3. Lock location indicated on drawings
4. Keying: Key all alike.
5. Locks when shown or called for shall be a 5-disc tumbler with heavy duty interchangeable cylinder. Exposed lock noses shall be dull nickel (satin) plated and stamped with identifying numbers. Locks shall have capacity for 2000 primary key changes. Master key one level with the potential of 10 different, non-interchangeable master key groups.
6. Pin Tumbler: Locks when shown or called for shall be a pin tumbler with heavy duty interchangeable cylinder. Exposed lock noses shall be dull nickel (satin) plated and stamped with identifying numbers. Locks shall have capacity of at least 1000 primary key changes, and the capacity to Masterkeyed, Grand-masterkeyed, Sub-masterkeyed, and Mason Keyed.

I. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.

1. Satin Stainless Steel: ANSI/BHMA 630.

J. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

2.5 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

2.6 CABINET CONSTRUCTION

A. Type of Construction: Frameless.

B. Door and Drawer-Front Style: Flush overlay.

C. General: All cabinets factory assembled. All exposed vertical and horizontal surfaces shall be finished with high pressure laminated plastic unless otherwise indicated. Materials not shown or specified, best quality manufacture's standard or as otherwise approved. All parts precision machined to close tolerances, accurately fitted and assembled with appropriate fastenings and adhesives required to produce first quality fixtures, square, true, level and plumb.

D. End Panels and Partitions: ¾ inch thick MDF with plastic-laminate faces and backs, edges faced with laminated plastic. Provide same grade, pattern, color, and texture of plastic laminate for backs as for faces. Backing sheet on interior or enclosed surfaces. End panels grooved to receive case backs, all parts lock-jointed.

E. Doors: ¾ inch thick MDF, front surfaced with laminated plastic and edged with 3mm PVC edging, backs surfaced with interior or backing sheet. Overlaid type doors. Where full height doors open.

F. Cabinet Backs: Groove all members to receive ¼" prefinished hardboard on unexposed backs where required or scheduled. Exposed backs and backs on movable cabinets, ½" overlaid plywood or MDF surfaced with laminated plastic. Interior face surfaced with backing sheet.

G. Drawers: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Overlaid type fronts, ¾" MDF surfaces with laminated plastic and 3mm PVC edging, backing sheet on inside face; sides and back ½" overlaid MDF. Join subfronts, backs and sides with glued dovetail joints. Smoothly sanded and coated with varnish drawer sealer.
2. Bottoms: ¼" thick prefinished hardboard. To match interior, housed into front, sides and back, glued and stapled.

H. Shelves: All shelving shall be MDF surfaces with overlay. All shelving shall be adjustable at 1" vertical intervals unless noted otherwise. All shelves drilled both ends for shelf clip

retainer pins. All shelves shall be 1" thick. Shelves longer than 36" shall have intermediate supports at 36" maximum spacing. Exposed shelves shall be edge-banded with 3mm PVC edging and plastic laminate finish on horizontal surface.

I. Filler and Service Access Panels: Provide filler and service access panels to conceal all utility piping, conduits and devices with finish to match adjacent surfaces. Provide removable panels secured with screws and grommets at valves, clean outs, devices and connectors that may require adjustment and service.

J. Framing: Complete skeleton frames and head rails of overlaid plywood, securely glue and dowel or other approved method, required under all countertop base cabinets.

K. Bases: Base material shall be from solid wood stock. Continuous bases leveled and squared before units are installed, cabinets leveled and anchored to base.

2.7 COUNTERTOPS

A. Solid Surface Countertops:

1. Manufacturer:

   a. Corian by Dupont
   b. Or approved equal

2. Solid surface ½" thick countertops with self-edge.
3. Back splashes shall be integral cove and be 6 inch high.
4. Tops and splashes shall be self-edged.
5. Outside corners at self-edge tops shall be rounded radius on all countertops.
6. Joints shall be fabricated to be flush with no color variation across the joint. At back splashes square butt joint end splashes of a corresponding height shall be furnished at wall or closed end.
7. Shop fabricate all components by a manufacturer approved fabricator.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify the adequacy and proper location of any required backing or support framing.

B. Verify that mechanical, electrical, plumbing, and other building components affecting work in this section are in place and ready.

C. All wall coverings and finishes referenced in Division 9 shall be installed prior to installation of this work.

3.2 PREPARATION

A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

3.3 INSTALLATION

A. Install all work in conformance with the North American Architectural Woodwork Standards, latest edition.

1. Installation shall conform to the NAAWS grade of the items being installed.

B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.

C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.

D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm) using concealed shims.

1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

E. Mechanical fasteners used at exposed and semi-exposed surfaces, excluding installation attachment screws and those securing cabinets end to end, shall be countersunk.

F. Fasten solid-surfacing-material countertops by screwing through corner blocks of base units into underside of countertop. Align adjacent surfaces, and form seams to comply with manufacturer's written instructions using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

3.4 FIELD QUALITY CONTROL

A. Inspections:

1. Provide inspection of installed Work through WI's Certified Compliance Program certifying that woodwork, including installation, complies with requirements of the North American Architectural Woodwork Standards for the specified grade.

a. Inspection entity shall prepare and submit report of inspection.

2. Provide Woodwork Institute Certified Seismic Installation System inspection reports and certificates as specified in Part 1 of this section.

3.5 ADJUSTING AND CLEANING

A. Before completing installation, the installer shall adjust all moving and operating parts to function smoothly and correctly.

B. All nicks, chips, and scratches in the finish shall be filled and retouched. Damaged items that cannot be repaired shall be replaced.

C. Adjust joinery for uniform appearance.

D. Clean, lubricate, and adjust hardware.

E. Clean cabinets on exposed and semiexposed surfaces.

F. Installer shall advise Contractor of final protection and maintained conditions necessary to ensure that work will be without damage or deterioration time of acceptance.

G. Cover completed work with 4 mil polyethylene protective enclosure, applied in a manner to allow easy removal without damaging cabinets or adjoining work. Remove cover immediately before time of final acceptance.

END OF SECTION 064116

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Penetration firestopping systems.

B. Related Requirements:

1. Section 078443 "Joint Firestopping" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

1.3 DEFINITIONS

A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in, or construction joints between, fire rated wall and floor assemblies.

1.4 REFERENCES

A. Test Requirements: ASTM E 814, "Standard Method of Fire Tests of Through Penetration Fire Stops"

B. Test Requirements: UL 1479, “Fire Tests of Through-Penetration Firestops”

C. Test Requirements: UL 2079, “Tests for Fire Resistance of Building Joint Systems”

D. Underwriters Laboratories (UL) of Northbrook, IL publishes tested systems in their "FIRE RESISTANCE DIRECTORY" that is updated annually.

1. UL Fire Resistance Directory:

a. Firestop Devices (XHJI)
b. Fire Resistance Ratings (BXRH)
c. Through-Penetration Firestop Systems (XHEZ)
d. Fill, Voids, or Cavity Material (XHHW)
e. Forming Materials (XHKU)
f. Perimeter Fire Containment Systems (XHDG)

2. Alternate Systems: “Omega Point Laboratories Directory” (updated annually).

E. Test Requirements: ASTM E 2307, “Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus”

F. Inspection Requirements: ASTM E 2174, “Standard Practice for On-site Inspection of Installed Fire Stops”

G. ASTM E 84, “Standard Test Method for Surface Burning Characteristics of Building Materials”

H. ASTM D6904, “Standard Practice for Resistance to Wind Driven Rain for Exterior Coatings Applied on Masonry”

I. ASTM C 679, “Standard Test Method for Tack-Free Time of Elastomeric Sealants

J. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments

K. International Building Code

L. NFPA 101 - Life Safety Code

M. NFPA 70 - National Electric Code

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide through-penetration fire stop systems and fire-resistive joint systems that comply with specified requirements of tested systems.

B. Firestop System installation must meet requirements of ASTM E 814, UL 1479 or UL 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated.

C. Proposed fire stop materials and methods shall conform to applicable governing codes having local jurisdiction.

D. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

E. For those firestop applications that exist for which no qualified tested system is available through a manufacturer, an engineering judgment derived from similar qualified tested system designs or other tests will be submitted to local authorities having jurisdiction for

their review and approval prior to installation. Engineering judgment documents must follow requirements set forth by the International Firestop Council.

1.7 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For sealants, indicating VOC content.

C. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.8 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.9 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

B. Documentation forms for each penetration firestopping system.

1.10 INSTALLER QUALIFICATIONS

A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer’s products per specified requirements. A supplier’s willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

B. The installer must have no less than 3 years of experience with fire stop installation.

1.11 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed through-penetration firestop systems similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in "Performance Requirements" Article:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, ITS, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
2. Through-penetration firestop systems are identical to those tested per ASTM E 814. Provide rated systems complying with the following requirements:.

    a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
    b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:

        1) UL in "Fire Resistance Directory."

1.12 DELIVERY, STORAGE AND HANDLING

A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.

B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.13 PROJECT CONDITIONS

A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

C. Do not use materials that contain flammable solvents.

D. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.

E. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

F. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

G. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

1.14 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.

B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

C. Provide a round fire-rated cable management device whenever cables penetrate fire rated walls, where frequent cable changes and additions may occur. The fire-rated cable management device shall consist of a corrugated steel tube with zinc coating, contain and inner plastic housing, intumescent material rings, and inner fabric smoke seal membrane. The length of the sleeve shall be 12.4 inches. The fire-rated cable management device shall contain integrated intumescent firestop wrap strip materials sufficient to maintain the hourly rating of the barrier being penetrated. The fire-rated cable management device shall contain a smoke seal fabric membrane or intumescent firestop plugs sufficient to achieve

the L-Rating requirements of the barrier type. Install device per the manufacturer's published installation instructions.

D. Fire-Test-Response Characteristics:

1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:

a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.

1) UL in its "Fire Resistance Directory."

2.2 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).

1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E84.

1. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

1. Permanent forming/damming/backing materials.
2. Substrate primers.
3. Collars.
4. Steel sleeves.

2.3 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with through penetration firestop systems (XHEZ) listed in Volume 2 of the UL Fire Resistance Directory; provide products of the following manufacturers as identified below:

1. Basis of Design:
   Hilti, Inc., Plano, Texas
   800-879-8000
   www.us.hilti.com
2. Substitution requests shall be considered provided a comparable UL listed system is provided along with the substituted materials and products.

2.4 MATERIALS

A. Use only firestop products that have been UL 1479, ASTM E 814 or UL 2079 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

B. Pre-formed firestop devices for use with noncombustible and combustible pipes (closed and open systems), conduit, and/or cable bundles penetrating concrete floors the following products are acceptable:

1. Hilti Cast-In Place Firestop Device (CP 680-P)
   a. Add Aerator Adaptor when used in conjunction with aerator system.
2. Hilti Cast-In Place Firestop Device (CP 680-M) for use with noncombustible penetrants.
3. Hilti Tub Box Kit (CP 681) for use with tub installations.
4. Hilti Firestop Speed Sleeve (CP 653) for use with cable penetrations.
5. Hilti Firestop Drop-In Device (CFS-DID) for use with noncombustible and combustible penetrants.
6. Hilti Firestop Block (CFS-BL)
7. Hilti Closet Stub (CFS-CID CS)

C. Sealants, caulking materials, or foams for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:

1. Hilti Intumescent Firestop Sealant (FS-ONE MAX)
2. Hilti Fire Foam (CP 620)
3. Hilti Flexible Firestop Sealant (CP 606)
4. Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG)
5. Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)

D. Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:

1. Hilti Silicone Sealant Gun Grade (CFS-S SIL GG)
2. Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)
3. Hilti Flexible Firestop Sealant (CP 606)
4. Hilti Intumescent Firestop Sealant (FS-ONE MAX)

E. Sealants, sprays, or pre-formed materials for use with fire-rated construction joints and other gaps, the following products are acceptable:

1. Hilti Firestop Top Track Seal (CFS-TTS)
2. Hilti Firestop Joint Spray (CFS-SP WB)
3. Hilti Firestop Silicone Joint Spray (CFS-SP SIL)
4. Hilti Flexible Firestop Sealant (CP 606)
5. Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG)
6. Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)
7. Hilti Bottom-of-Wall Sealant (CP 605)

F. Pre-formed mineral wool designed to fit flutes of metal profile deck and gap between top of wall and metal profile deck; as a backer for spray material.

1. Hilti Speed Plugs (CP 777)
2. Hilti Speed Strips (CP 767)

G. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, the following products are acceptable:

1. Hilti Intumescent Firestop Sealant (FS-ONE MAX)

H. Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles, the following products are acceptable:

1. Hilti Intumescent Firestop Sealant (FS-ONE MAX)
2. Hilti Fire Foam (CP 620)
3. Hilti Flexible Firestop Sealant (CP 606)
4. Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG)
5. Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)

I. Non-curing, re-penetrable intumescent putty or foam materials for use with flexible cable or cable bundles, the following products are acceptable:

1. Hilti Firestop Putty Stick (CP 618)
2. Hilti Firestop Plug (CFS-PL)

J. Wall opening protective materials for use with U.L. listed metallic and specified nonmetallic outlet boxes, the following products are acceptable:

1. Hilti Firestop Putty Pad (CFS-P PA)
2. Hilti Firestop Putty Pad (CP 617)
3. Hilti Firestop Box Insert

K. Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems), the following products are acceptable:

1. Hilti Firestop Collar (CP 643N)
2. Hilti Firestop Collar (CP 644)
3. Hilti Wrap Strips (CP 648-E/648-S)

L. Materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:

1. Hilti Firestop Block (CFS-BL)
2. Hilti Composite Sheet (CFS-COS)
3. Hilti Firestop Mortar (CP 637)
4. Hilti Fire Foam (CP 620)
5. Hilti Firestop Board (CP 675T)

M. Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:

1. Hilti Firestop Block (CFS-BL)
2. Hilti Firestop Board (CP 675T)

N. Re-penetrable, round cable management devices for use with new or existing cable bundles penetrating gypsum or masonry walls, the following products are acceptable:

1. Hilti Firestop Speed Sleeve (CP 653) with integrated smoke seal fabric membrane.
2. Hilti Firestop Cable Collar (CFS-CC)
3. Hilti Firestop Sleeve (CFS-SL SK)
4. Hilti Retrofit Sleeve (CFS-SL RK) for use with existing cable bundles.
5. Hilti Gangplate (CFS-SL GP) for use with multiple cable management devices.
6. Hilti Gangplate Cap (CFS-SL GP CAP) for use at blank openings in gangplate for future penetrations.

O. Sealants or caulking materials used for openings between structurally separate sections of wall and floors, the following products are acceptable:

1. Hilti Firestop Joint Spray (CFS-SP WB)
2. Hilti Flexible Firestop Sealant (CP 606)
3. Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG)
4. Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)

P. For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables is expected, the following products are acceptable:

1. Hilti Firestop Block (CFS-BL)
2. Hilti Firestop Plug (CFS-PL)

Q. For single or cable bundles up to one inch diameter penetrating gypsum, masonry, concrete walls or wood floor assemblies the following product is acceptable:

1. Hilti Firestop Cable Disc (CFS-D)

2.5 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.

D. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.

E. Verify penetrations are properly sized and in suitable condition for application of materials.

3.3 COORDINATION

A. Coordinate construction of openings and penetrations to ensure that the fire stop systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration fire stop systems.

C. Coordinate fire stopping with other trades so that obstructions are not placed in the way prior to the installation of the fire stop systems.

D. Do not cover up through-penetration fire stop and joint system installations that will become concealed behind other construction until each installation has been examined by the building inspector.

3.4 INSTALLATION

A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory.

B. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

C. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

D. Install fill materials by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.5 IDENTIFICATION

A. The firestop contractor is to supply documentation for each single application addressed. This documentation is to identify each penetration and joint location on the entire project. The Documentation Form for through penetrations is to include:

1. A Sequential Location Number
2. The Project Name
3. Date of Installation
4. Detailed Description of the Penetration’s Location
5. Tested System or Engineered Judgment Number
6. Type of Assembly Penetrated
7. A Detailed Description of the Size and Type of Penetrating Item
8. Size of Opening
9. Number of Sides of Assemblies Addressed
10. Hourly Rating to be Achieved
11. Installer’s Name

B. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches (76 mm) high and with minimum 0.375-inch (9.5-mm) strokes.

1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet (4.57 m) from end of wall and at intervals not exceeding 30 feet (9.14 m).

C. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.6 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E2174.

B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.7 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION 078413

SECTION 078443 - JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Intumescent gypsum wall framing gaskets.
2. Perimeter fire-barrier system.
3. Joints in or between fire-resistance-rated construction.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers and for wall identification.

1.3 DEFINITIONS

A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in, or construction joints between, fire rated wall and floor assemblies.

1.4 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. ASTM E 814, "Standard Method of Fire Tests of Through Penetration Fire Stops"
2. ASTM E 1966, “Standard Test Method for Fire Resistive Joint Systems”
3. ASTM E 2307, “Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus”
4. ASTM E 84, “Standard Test Method for Surface Burning Characteristics of Building Materials”
5. ASTM D6904, “Standard Practice for Resistance to Wind Driven Rain for Exterior Coatings Applied on Masonry”
6. ASTM C 679, “Standard Test Method for Tack-Free Time of Elastomeric Sealants

B. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments

C. International Building Code

D. NFPA 101 - Life Safety Code

E. NFPA 70 - National Electric Code

F. Underwriters Laboratories (UL)

1. UL 2079, “Tests for Fire Resistance of Building Joint Systems”
2. UL Fire Resistance Directory:

    a. Firestop Devices (XHJI)
    b. Fire Resistance Ratings (BXRH)
    c. Forming Materials (XHKU)
    d. Joint Systems (XHBN)
    e. Perimeter Fire Containment Systems (XHDG)

3. Alternate Systems: “Omega Point Laboratories Directory” (updated annually).

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide through-penetration fire stop systems and fire-resistive joint systems that comply with specified requirements of tested systems.

B. Firestop System installation must meet requirements of ASTM E 814, UL 1479 or UL 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated.

C. Proposed fire stop materials and methods shall conform to applicable governing codes having local jurisdiction.

D. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

E. For those firestop applications that exist for which no qualified tested system is available through a manufacturer, an engineering judgment derived from similar qualified tested system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment documents must follow requirements set forth by the International Firestop Council.

1.7 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For sealants, indicating VOC content.
2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

C. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.8 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each joint firestopping system, for tests performed by a qualified testing agency.

1.9 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

B. Documentation forms for each joint firestop system.

1.10 INSTALLER QUALIFICATIONS

A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer’s products per specified requirements. A supplier’s willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

B. The installer must have no less than 3 years of experience with fire stop installation.

1.11 DELIVERY, STORAGE AND HANDLING

A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.

B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements, including temperature restrictions.

D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

E. Do not use damaged or expired materials.

1.12 PROJECT CONDITIONS

A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

C. Do not use materials that contain flammable solvents.

D. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.

E. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

F. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

G. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

1.13 COORDINATION

A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.

B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

C. Provide a round fire-rated cable management device whenever cables penetrate fire rated walls, where frequent cable changes and additions may occur. The fire-rated cable management device shall consist of a corrugated steel tube with zinc coating, contain and inner plastic housing, intumescent material rings, and inner fabric smoke seal membrane. The length of the sleeve shall be 12.4 inches. The fire-rated cable management device shall contain integrated intumescent firestop wrap strip materials sufficient to maintain the hourly rating of the barrier being penetrated. The fire-rated cable management device shall contain a smoke seal fabric membrane or intumescent firestop plugs sufficient to achieve the L-Rating requirements of the barrier type. Install device per the manufacturer’s published installation instructions.

D. Fire-Test-Response Characteristics:

1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:

a. Joint firestopping systems shall bear classification marking of a qualified testing agency.

1) UL in its "Fire Resistance Directory."

2.2 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with joint systems (XHBN), and perimeter firestop systems (XHDG) listed in Volume 2 of the UL Fire Resistance Directory; provide products of the following manufacturers as identified below:

1. Basis of Design:
Hilti, Inc., Plano, Texas
800-879-8000
www.us.hilti.com
2. Substitution requests shall be considered provided a comparable UL listed system is provided along with the substituted materials and products.

2.3 JOINT FIRESTOPPING SYSTEMS

A. General: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems must accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

1. Joint firestopping systems that are compatible with one another, with the substrates forming openings, and with penetrating items, if any.
2. Provide products that, upon curing, do not re-emulsify, dissolve, leach, break down, or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture.
3. Provide firestop products that do not contain ethylene glycol.

B. Intumescent Gypsum Wall Framing Gaskets: Applied to steel tracks, runners, and studs prior to framing installation. Provide products with fire, smoke, and acoustical ratings that allow movement of up to 100 percent compression and/or extension when tested in accordance with UL 2079 or ASTM E1966; have an L Rating of less than 1 cfm/ft. (0.00115 cu. m/s x m) when tested in accordance with UL 2079; and a minimum Sound Transmission Class (STC) rating of 56 when tested in accordance with ASTM E90 or ASTM C919.

C. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined in accordance with ASTM E1966 or UL 2079, with published L-Ratings for ambient and elevated temperatures as evidence of the ability of the fire-resistive joint system to restrict the movement of smoke.

1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.

D. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.

1. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

E. Accessories: Provide components of joint firestopping systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

2.4 MATERIALS

A. Use only firestop products that have been UL 1479, ASTM E 814 or UL 2079 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

B. Sealants, sprays, or pre-formed materials for use with fire-rated construction joints and other gaps, the following products are acceptable:

1. Hilti Firestop Top Track Seal (CFS-TTS)
2. Hilti Firestop Joint Spray (CFS-SP WB)
3. Hilti Firestop Silicone Joint Spray (CFS-SP SIL)
4. Hilti Flexible Firestop Sealant (CP 606)
5. Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG)
6. Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)
7. Hilti Bottom-of-Wall Sealant (CP 605)

C. Pre-formed mineral wool designed to fit flutes of metal profile deck and gap between top of wall and metal profile deck; as a backer for spray material.

1. Hilti Speed Plugs (CP 777)
2. Hilti Speed Strips (CP 767)

D. Sealants or caulking materials used for openings between structurally separate sections of wall and floors, the following products are acceptable:

1. Hilti Firestop Joint Spray (CFS-SP WB)
2. Hilti Flexible Firestop Sealant (CP 606)
3. Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG)
4. Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Before installing joint firestopping systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:

1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

D. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.

E. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.

3.3 COORDINATION

A. Coordinate construction of joints to ensure that the fire stop system are installed according to specified requirements.

B. Coordinate construction and sizing of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

3.4 INSTALLATION

A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory.

B. General: Install joint firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

C. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

D. Install elastomeric fill materials for joint firestopping systems by proven techniques to produce the following results:

1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.5 DOCUMENTATION

A. The firestop contractor is to supply documentation for each single application addressed. This documentation is to identify each penetration and joint location on the entire project. The Documentation Form for Construction Joints is to include:

1. A Sequential Location Number
2. The Project Name
3. Date of Installation
4. Detailed Description of the Construction Joint's Location
5. Tested System or Engineered Judgment Number
6. Type of Construction Joint
7. The Width of the Joint
8. The Lineal Footage of the Joint
9. Number of Sides Addressed
10. Hourly Rating to be Achieved
11. Installer's Name

3.6 IDENTIFICATION

A. Wall Identification: Permanently label walls containing firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches (76 mm) high and with minimum 0.375-inch (9.5-mm) strokes.

1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 ft. (4.57 m) from end of wall and at intervals not exceeding 30 ft. (9.14 m).

B. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of joint edge, so labels are visible to anyone seeking to remove joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.7 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E2393.

B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.

C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.8 CLEANING AND PROTECTION

A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated joint firestopping systems immediately and install new materials to produce joint firestopping systems complying with specified requirements.

END OF SECTION 078443

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Urethane joint sealants.
4. Mildew-resistant joint sealants.
5. Butyl joint sealants.
6. Latex joint sealants.

B. Related Requirements:

1. Section 018113.71 “Sustainable Design Requirements – CalGreen Non-Residential Mandatory” for VOC limits, exclusions of toxic materials, documentation and compliance.
2. Section 092900 “Gypsum Board” for sealing joints in sound-rated construction.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and substrate material to be tested:

1. Joint-sealant location and designation.
2. Manufacturer and product name.
3. Type of substrate material.
4. Proposed test.
5. Number of samples required.

D. Preconstruction Laboratory Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.

E. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

F. Field-Adhesion-Test Reports: For each sealant application tested.

G. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: Qualified according to ASTM C1021 to conduct the testing indicated.

C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Adhesion Testing: Use ASTM C794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Compatibility Testing: Use ASTM C1087 to determine sealant compatibility when in contact with glazing and gasket materials.
3. Stain Testing: Use ASTM C1248 to determine stain potential of sealant when in contact with masonry substrates.
4. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
5. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
6. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
7. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each kind of sealant and joint substrate.
3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.

    a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.

        1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.

6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.8 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.9 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. CalGreen Compliance: For all interior applications, refer to Section 018113.71 "Sustainable Design Requirements – CalGreen Non-Residential Mandatory" for VOC limits, exclusions of toxic materials, documentation and compliance.

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 joint-sealant manufacturer, based on testing and field experience.

1. Joint sealants at exterior shall be compatible with all components of the exterior waterproofing system that they contact.

C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Tremco Incorporated; Spectrem 1
b. Sika Corporation; Sikasil WS-290
c. Or approved equal

B. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Tremco Incorporated; Spectrem 2
b. Sika Corporation; Sikasil WS-295
c. Or approved equal

C. Silicone, S, NS, 35, NT: Single-component, nonsag, plus 35 percent and minus 35 percent movement capability. nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 35, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Sika Corporation; Sikasil WS-295 exceeds this spec with 50% movement capability

b. Or approved equal

D. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Sika Corporation; Sikasil WS-295 exceeds this spec with 50% movement capability
b. Or approved equal

E. Silicone, Acid Curing, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant: ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Tremco Incorporated; Tremsil 200
b. Sika Corporation; Sikasil GP
c. Or approved equal

F. Silicone, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Tremco Incorporated; Spectrem 800
b. Sika Corporation; Sikasil 728 NS
c. Or approved equal

G. Silicone, S, NS, 50, T, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Uses T and NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Sika Corporation; Sikasil 728 NS exceeds this spec with +100%/-50% movement
b. Or approved equal

H. Silicone, S, NS, 25, T, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Uses T and NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Sika Corporation; Joint Sealants; Sikasil 728 NS exceeds this spec with +100%/-50% movement

b. Or approved equal

I. Silicone, S, P, 100/50, T, NT: Single-component, pourable, plus 100 percent and minus 50 percent movement capability traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 100/50, Uses T and NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Tremco Incorporated; Spectrem 900SL
b. Sika Corporation; Sikasil 728 SL
c. Or approved equal

J. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Sika Corporation; Sikasil 728 SL exceeds this spec with +100% & -50% movement
b. Or approved equal

K. Silicone, M, P, 100/50, T, NT: Multicomponent, pourable, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type M, Grade P, Class 100/50, Uses T and NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Sika Corporation; Joint Sealants; Sikasil 728 RCS.

2.3 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C1248.

B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Tremco Incorporated; Spectrem 1.
b. Sika Corporation; Sikasil WS-290
c. Or approved equal

C. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Tremco Incorporated; Spectrem 3
    b. Sika Corporation; Sikasil WS-295
    c. Or approved equal

D. Silicone, Nonstaining, S, NS, 100/50, T, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Sika Corporation; Sikasil-728 NS
    b. Or approved equal

E. Silicone, Nonstaining, M, NS, 50, NT: Nonstaining, multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type M, Grade NS, Class 50, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Sika Corporation; Sikasil-728 RCS

2.4 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Bostik, Inc; Chem-Calk 900, Chem-Calk 915, Chem-Calk 916, Chem-Calk GPS1.
    b. Pecora Corporation; Dynatrol I-XL.
    c. Sika Corporation; Joint Sealants; Sikaflex Textured Sealant
    d. Tremco Incorporated; Vulkem 116

B. Urethane, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Tremco Incorporated; Dymonic 100
    b. Or approved equal

C. Urethane, S, NS, 25, T, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Uses T and NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Tremco Incorporated; Vulkem 116
b. Sika Corporation; Sikaflex 1A exceeds this spec with +35% & -35% movement capability
c. Or approved equal

D. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Sika Corporation; Sikaflex 1c SL
b. Or approved equal

E. Urethane, M, NS, 50, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 50, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Tremco Incorporated; Dymeric 240FC
b. Sika Corporation; Sikaflex 2c NS EZ Mix
c. Or approved equal

F. Urethane, M, NS, 25, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 25, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Sika Corporation; Sikaflex 2c NS EZ Mix exceeds this spec with +50% & -50% movement capability
b. Or approved equal

G. Urethane, M, NS, 50, T, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 50, Uses T and NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Tremco Incorporated; Dymeric 240FC
b. Sika Corporation; Sikaflex 2c NS EZ Mix
c. Or approved equal

H. Urethane, M, NS, 25, T, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 25, Uses T and NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Sika Corporation; Joint Sealants; Sikaflex 2c NS TG

I. Urethane, M, P, 25, T, NT: Multicomponent, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade P, Class 25, Uses T and NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Sika Corporation; Joint Sealants; Sikaflex 2c SL.
b. Or approved equal

2.5 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Tremco Incorporated; Tremsil 200.
b. Sika Corporation; Sikasil-GP
c. Or approved equal

C. STPE, Mildew Resistant, S, NS, 50, NT: Mildew-resistant, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, silyl-terminated polyether joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Sika Corporation; SikaHyflex-150 LM
b. Or approved equal

2.6 BUTYL JOINT SEALANTS

A. Butyl Elastomer Joint Sealants: VOC compliant

1. Products: Subject to compliance with requirements, provide the following:

a. Tremco Incorporated; Trempro JS-773

b. Or approved equal

2.7 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Tremco Incorporated; Tremflex 834.
b. Sika Corporation; Sikacryl-20 FC
c. Or approved equal

2.8 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Adfast.
b. Alcot Plastics Ltd.
c. Construction Foam Products; a division of Nomaco, Inc.
d. Master Builders Solutions.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin) Type O (open-cell material) Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.9 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C1193 unless otherwise indicated.
4. Provide flush joint profile at locations indicated on Drawings according to Figure 8B in ASTM C1193.
5. Provide recessed joint configuration of recess depth and at locations indicated on Drawings according to Figure 8C in ASTM C1193.

    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 FIELD QUALITY CONTROL

A. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 EXTERIOR JOINT-SEALANT SCHEDULE

A. Exterior perimeter joints at frames of doors, windows, and louvers.

1. Joint Sealant: Single-component neutral-curing non-staining silicone sealant.

    a. Tremco Spectrem 1, Spectrem 2
    b. Sika Corporation; Sikasil WS-290; Sikasil WS-295

2. Joint Sealant: Multi-component neutral-curing non-staining field tintable silicone sealant.

    a. Tremco Spectrem 4-TS
    b. Sika Corporation; Sikasil WS-295 FPS

3. Joint Sealant: Single-component non-sag urethane sealant.

    a. Tremco Dymonic 100

4. Joint-Sealant Color: As selected by Architect from manufacturer's standard colors Multiple colors required to match several conditions.

B. Exterior joints within aluminum storefront framing, curtain walls, and window systems:

1. Joint Sealant: Single-component neutral-curing non-staining silicone sealant.

a. Tremco Spectrem 1, Spectrem 2
b. Sika Corporation; SikaHyflex-150 LM

2. Joint-Sealant Color: As selected by Architect from manufacturer's standard colors.

C. All other exterior non-traffic joints.

1. Joint Sealant: Single-component neutral-curing non-staining silicone sealant.

a. Tremco Spectrem 1, Spectrem 2
b. Sika Corporation; Sikasil WS-290; Sikasil WS-295

2. Joint Sealant: Multi-component neutral-curing non-staining field tintable silicone sealant.

a. Tremco Spectrem 4-TS
b. Sika Corporation; Sikasil WS-295 FPS

3. Joint Sealant: Single-component non-sag urethane sealant.

a. Tremco Dymonic 100
b. Sika Corporation; SikaHyflex-150 LM

4. Joint-Sealant Color: As selected by Architect from manufacturer's standard colors Multiple colors required to match several conditions.

3.8 INTERIOR JOINT-SEALANT SCHEDULE

A. Interior perimeter joints of interior frames.

1. Joint Sealant: Single-component non-sag urethane sealant, Greenguard certified.

a. Tremco Dymonic 100
b. Sika Corporation; SikaHyflex-150 LM

2. Joint Sealant: Siliconized acrylic latex, Greenguard certified

a. Tremco Tremflex 834.
b. Sika Corporation; Sikacryl-20 FC

3. Joint-Sealant Color: Paintable.

B. Interior sanitary joints between plumbing fixtures, food preparation fixtures, and casework and adjacent walls, floors, and counters.

1. Joint Sealant: Mildew-Resistant, Single-Component, nonsag, acid-curing silicone joint sealant, Greenguard certified.

a. Tremsil 200.
b. Sika Corporation; Sikasil-GP

2. Joint-Sealant Color: As selected by Architect from manufacturer's full range; multiple colors required.

C. Interior non-moving joints between interior painted surfaces and adjacent materials.

1. Joint Sealant: Siliconized acrylic latex, Greenguard certified

a. Tremco Tremflex 834
b. Sika Corporation; Sikacryl-20 FC

2. Joint-Sealant Color: Paintable.

D. Interior concealed sealants at thresholds and sills.

1. Joint Sealant: Butyl-rubber-based joint sealant.

a. Tremco Trempro JS-773

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Interior custom hollow-metal doors and frames.
2. Exterior custom hollow-metal doors and frames.

B. Related Requirements:

1. Section 087111 "Door Hardware" for door hardware for hollow-metal doors.
2. Section 081416 “Flush Wood Doors”
3. Section 088000 “Glazing”

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.4 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Coordinate requirements for installation of door hardware.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

C. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of glazing frames and stops showing glazing
7. Indicate coordination of glazing frames and stops with glass and glazing requirements
8. Details of anchorages, joints, field splices, and connections.
9. Details of accessories.
10. Details of moldings, removable stops, and glazing.

D. Coordination Drawings: Drawings of each opening, including door and frame, drawn to scale and coordinating door hardware. Show elevations of each door design type, showing dimensions, locations of door hardware.

E. Samples for Initial Selection: For hollow-metal doors and frames with factory-applied color finishes.

F. Samples for Verification:

1. Finishes: For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (75 by 127 mm).

G. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.

B. Product Test Reports: For each type of fire-rated hollow-metal door and frame assembly fire-rated borrowed-lite assembly windborne-debris impact resistance door and thermally rated door assemblies for tests performed by a qualified testing agency indicating compliance with performance requirements.

C. Field quality control reports.

1.8 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.9 QUALITY ASSURANCE

A. Provide doors and frames complying with Hollow Metal Manufacturer's Association "Guide Specifications for Commercial Hollow Metal Doors and Frames" HMMA 861-00 and as herein specified.

B. Installer Qualifications: An employer of workers trained and approved by manufacturer.

C. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.

D. Source Limitations: Obtain custom steel doors and frames through one source from a single manufacturer.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1. If wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.11 PROJECT CONDITIONS

A. Field Measurements: Verify openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.12 COORDINATION

A. Coordinate installation of anchorages for custom steel frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Curries; a brand of ASSA ABLOY.
2. Steelcraft; an Allegion brand.
3. Stiles Custom Metal, Inc.
4. Titan Metal Products.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure according to NFPA 252 or UL 10C.

B. Fire-Rated, Borrowed-Lite Assemblies: Assemblies complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

C. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.70 per Cal Green Table 140.3-B.

2.3 CUSTOM HOLLOW-METAL DOORS AND FRAMES

A. Commercial Doors and Frames: NAAMM-HMMA 861; ANSI/SDI A250.4, Physical Performance Level A. At locations indicated in the Door and Frame Schedule.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches (44.5 mm).
c. Exterior Door Face Sheet: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.30 mm), with minimum G60 or A60 (ZF180) coating.
d. Interior Door Face Sheet: Fabricated from minimum 0.042-inch thick, cold-rolled steel sheet, unless otherwise indicated to comply with exterior door face sheet requirements.
e. Edge Construction: Continuously welded with no visible seam.
f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets with steel channel spot weld, not more than 6 inches o.c. to face sheets. Seal joints against water penetration.

    1) Tops and bottoms of doors reinforced with inverted horizontal channels, continuous across full width of door, of same material as face sheets so flanges of channels are even with bottom and top edges of face sheets.
    2) Top and bottom edges of doors closed with closing channels of same material and thickness as face sheets; welded so webs of channels are flush with door edges.

g. Bottom Edges: Close bottom edges of doors with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
h. Core: Fabricate doors with core indicated. Provide thermal-resistance-rated cores for exterior doors where indicated.

    1) Manufacturer's Standard.
    2) Polystyrene.
    3) Polyurethane.
    4) Polyisocyanurate.
    5) Fire-Rated Door Core: As required to provide fire-protection and temperature-rise ratings indicated.

i. Hardware Reinforcement: Fabricate reinforcement plates from same material as door face sheets to comply with the following minimum sizes:

    1) Hinges and Pivots: Minimum 0.194 inch thick by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
    2) Lock Face, Flush Bolts, and Concealed Holders: Minimum 0.093 inch thick.
    3) Closers: Minimum 0.104 inch thick.
    4) All Other Surface-Mounted Hardware: Minimum 0.067 inch thick.

2. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), except 0.067 inch (1.7 mm) for openings exceeding 4 feet (1219 mm) wide; with minimum G60 or A60 (ZF180) coating.

b. Construction: Full profile welded
c. Hardware Reinforcement: Fabricate reinforcement plates from same material as frames to comply with the following minimum sizes:

1) Hinges and Pivots: Minimum 0.194 inch thick by 1-1/4 inches wide by 10 inches long, secured by not less than 6 spot welds.
2) Strikes , Flush Bolts: Minimum 0.093 inch thick.
3) Closers and Hold-Open Arms: Minimum 0.104 inch thick.
4) Surface-Mounted Hardware: Minimum 0.093 inch thick.

d. Head Reinforcement: Minimum 0.093-inch- thick, steel channel or angle stiffener.

3. Exposed Finish: Prime.

2.4 BORROWED LITES

A. Fabricate of metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm).

B. Construction: Full profile welded.

C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.

D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.

a. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
b. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches (610 mm) of frame height above 7 feet (2.1 m).
3. Postinstalled Expansion Anchor: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized according to ASTM A153/A153M, Class B.

2.6 DOOR LOUVERS

A. Provide sight-proof vandal proof stationary louvers for doors where indicated, constructed of inverted V-shaped or Y-shaped blades formed of 0.035 inch thick cold rolled steel sheet set into 0.035 inch thick steel frame. Verify locations with mechanical drawings.

B. Provide high security sight-proof grill with louvers for doors where indicated, constructed of 12 gauge cold rolled steel grill with inverted V-shaped blades. Through-bolt attachments for frame to door. Verify locations with mechanical drawings.

2.7 MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

C. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

D. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

E. Supports and Anchors: Fabricated from not less than 18 gage galvanized sheet steel.

F. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M class C or D as applicable.

G. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

H. Glazing: Comply with requirements in Section 088000 "Glazing."

I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

J. Primer: Rust inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints.

2.8 FABRICATION

A. General: Fabricate custom steel doors and frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

1. Single-Acting Doors: Bevel both vertical edges 1/8 inch in 2 inches.

B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding according to joint designs in HMMA 820.

a. Provide false head member to receive lower ceiling where frames extend to finish ceilings of different heights.

2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

3. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
4. Jamb Anchors: Provide number and spacing of anchors as follows:

a. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

1) Three anchors per jamb up to 60 inches in height.
2) Four anchors per jamb from 60 to 90 inches in height.
3) Five anchors per jamb from 90 to 96 inches in height.
4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof more than 96 inches in height.
5) Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.

b. Compression Type: Not less than two anchors in each jamb.

c. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

5. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to ANSI/SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

D. Glazed Lites: Factory cut openings in doors. Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with mitered hairline joints.

1. Provide stops and moldings flush with face of door, and with beveled stops unless otherwise indicated.
2. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of door or frame.
3. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
4. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
6. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

2.9 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
2. Refer to section 099114 “Exterior Painting” and 099124 “Interior Painting” for paint.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of custom steel doors and frames.

1. Examine roughing-in for embedded and built-in anchors to verify actual locations of custom steel frame connections before frame installation.
2. For the record, prepare written report to Architect, endorsed by Installer, listing conditions detrimental to performance of work.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Prior to installation and with installation spreaders in place, adjust and securely brace custom steel door frames for squareness, alignment, twist, and plumb to the following tolerances:

1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with NAAMM-HMMA 840.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
b. Install frames with removable stops located on secure side of opening.

2. Fire-Rated Openings: Install frames according to NFPA 80.
3. Floor Anchors: Secure with postinstalled expansion anchors.

4. Solidly pack mineral-fiber insulation inside frames.
5. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

1. Non-Fire-Rated Steel Doors: Comply with NAAMM-HMMA 841 and NAAMM-HMMA guide specification indicated.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

A. Inspections:

1. Fire-Rated Door Inspections: Inspect each fire-rated door according to NFPA 80, Section 5.2.
2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements according to NFPA 101, Section 7.2.1.15.

B. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

C. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

D. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.5 REPAIR

A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Five-ply flush wood doors and transom panels for opaque finish.
2. Factory priming flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Requirements:
1. Section 088000 "Glazing" for glass view panels in flush wood doors.
2. Section 099114 "Exterior Painting" and Section 099124 "Interior Painting" for field finishing doors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door louvers.
5. Door trim for openings.
6. Door frame construction.
7. Factory-machining criteria.
8. Factory-priming specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door schedule indicating door location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Details of frame for each frame type, including dimensions and profile.
4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.

5. Dimensions and locations of blocking for hardware attachment.
6. Dimensions and locations of mortises and holes for hardware.
7. Clearances and undercuts.
8. Requirements for veneer matching.
9. Doors to be factory primed and application requirements.

C. Samples for Verification:
1. Corner sections of doors, approximately 8 by 10 inches (200 by 250 mm), with door faces and edges representing actual materials to be used.
2. Louver blade and frame sections, 6 inches (150 mm) long, for each material and finish specified.
3. Frames for light openings, 6 inches (150 mm) long, for each material, type, and finish required.

D. Provide schedule of doors and frames using same reference numbers for details and openings as those on contract drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For door inspector.
1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
2. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
3. Submit copy of DHI's Fire and Egress Door Assembly Inspector (FDAI) certificate.

B. Field quality-control reports.

C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Special warranties.

B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.6 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies shall comply with qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:

1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

B. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies shall comply with qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:

1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons, and wrap bundles of doors in plastic sheeting.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.8 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install doors until building is enclosed and weathertight, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 25 and 55 percent during remainder of construction period.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Delamination of veneer.
   b. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
   c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.

2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Wood Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.3 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with ANSI/WDMA I.S. 1A “Industry Standard for Interior Architectural Wood Flush Doors”.

B. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Composite Wood Products: Verify products are made using ultra-low-emitting formaldehyde resins, as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products," or are made with no added formaldehyde.

2.4 SOLID-CORE FIVE-PLY FLUSH WOOD DOORS AND TRANSOM PANELS FOR OPAQUE FINISH

A. Interior Solid-Core Doors

1. Products: Subject to compliance with requirements, provide the following:

    a. Masonite Architectural; CENDURA Series Standard Painted.

2. Performance Grade: ANSI/WDMA I.S. 1A Extra Heavy Duty.
3. Aesthetic Grade: ANSI/WDMA I.S. 1A Custom.
4. Faces: MDO.

    a. Apply MDO to standard-thickness, closed-grain, hardwood face veneers.

5. Exposed Vertical Edges: Any closed-grain hardwood.

    a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.

6. Core for Non-Fire-Rated Doors:

    a. ANSI A208.1, Grade LD-1 wood-based particleboard.

        1) Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.

    b. Glued wood stave.
    c. WDMA I.S. 10 structural composite lumber.

        1) Screw Withdrawal, Door Face: 550 lbf (2440 N).
        2) Screw Withdrawal, Vertical Door Edge: 550 lbf (2440 N).

    d. Either glued wood stave or WDMA I.S. 10 structural composite lumber.

7. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.

    a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as needed to eliminate through-bolting hardware.

8. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.5 LIGHT FRAMES AND LOUVERS

A. Factory Glazing: Refer to Section 088000 “Glazing” for glass view panels in flush wood doors. Factory install glass as required. Fill glazing bead nail holes in factory finished doors.

B. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.

1. Wood Species: Same species as door faces.
2. Profile: Flush rectangular beads.
3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.

C. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- (1.2-mm-) thick, cold-rolled steel sheet; with baked-enamel or powder-coated finish; and approved for use in doors of fire-protection rating indicated on Drawings.

D. Metal Louvers:

1. Blade Type: Vision-proof, inverted V or Vision-proof, inverted Y.
2. Metal and Finish: Hot-dip galvanized steel, 0.040 inch (1.0 mm) thick, factory primed for paint finish.

E. Louvers for Fire-Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire-protection rating of 1-1/2 hours and less.
   1. Metal and Finish: Hot-dip galvanized steel, 0.040 inch (1.0 mm) thick, factory primed for paint finish.

2.6 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.

   1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
   2. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.

   1. Locate hardware to comply with DHI-WDHS-3.
   2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
   3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
   4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.

C. Openings: Factory cut and trim openings through doors.

   1. Light Openings: Trim openings with moldings of material and profile indicated.
   2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."
   3. Louvers: Factory install louvers in prepared openings.

2.7 FACTORY PRIMING

A. Doors for Opaque Finish: Factory prime faces, all four edges, edges of cutouts, and mortises with one coat of wood primer specified in Section 099124" Interior Painting."

2.8 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.

   1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
   2. Finish faces, all four edges, edges of cutouts, and mortises.
   3. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Opaque Finish:

1. ANSI/WDMA I.S. 1A Grade: Same as door grade.

    a. OP-8 UV Cured Acrylated Polyester/Urethane.

2. Color: As selected by Architect from manufacturer's full range.
3. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Section 087111 "Door Hardware."

B. Reference Standards:

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

C. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

D. Job-Fitted Doors:

1. Align and fit doors in frames with uniform clearances and bevels as indicated below.

    a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.

2. Machine doors for hardware.
3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
4. Clearances:

    a. Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors.
    b. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.

c. Where threshold is shown or scheduled, provide1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.
d. Comply with NFPA 80 for fire-rated doors.

5. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
6. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock edge; trim stiles and rails only to extent permitted by labeling agency.

E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

F. Field-Finished Doors: Refer to the following for finishing requirements:

1. For doors with opaque finish: Section 099124" Interior Painting."

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:
1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80.

3.4 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

3.5 CLEANING

A. Clean glass and hardware units promptly after installation in accordance with manufacturer's printed instructions.

B. Construction Waste Management: Manage construction waste in accordance with provisions of Section 017419 Construction Waste Management and Disposal.

3.6 PROTECTION

A. Protect installed units to ensure that they are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 081416

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Access doors and frames.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches (150 by 150 mm) in size.

C. Product Schedule: For access doors and frames. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES

A. Flush Access Doors with Exposed Flanges:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Karp Associates, Inc; DSC-214M & SM.
b. Milcor; Hart & Cooley, Inc.; Architectural Access Door (M).
c. Nystrom, Inc.; Architectural Access Door.

2. Description: Face of door flush with frame, with exposed flange and concealed hinge.

3. Locations: Wall.
4. Door Size: 14 inch by 14 inch, unless otherwise noted.

1. Door Material: Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch (1.63 mm), 16 gage, factory primed.
2. Frame Material: Same material, thickness, and finish as door.

3. Latch and Lock: Screwdriver operated cam latch.
4. Finish: Paint to match adjacent surface.

2.2 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

C. Stainless Steel Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, Type 304. Remove tool and die marks and stretch lines, or blend into finish.

D. Stainless Steel Flat Bars: ASTM A666, Type 304. Remove tool and die marks and stretch lines, or blend into finish.

E. Frame Anchors: Same material as door face.

F. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.3 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling. Provide access sleeves for each latch operator and install in holes cut through finish.

E. Latch and Lock Hardware:

1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
2. Keys: Furnish two keys per lock and key all locks alike.

2.4 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

E. Stainless Steel Finishes:

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finish: ASTM A480/A480M No. 4 finish. Grind and polish surfaces to produce uniform finish, free of cross scratches.

a. Run grain of directional finishes with long dimension of each piece.
b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

3. Bright, Cold-Rolled, Unpolished Finish: ASTM A480/A480M No. 2B.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Surfaces should be structurally sound, free of voids, spalls, loose aggregate and sharp ridges. Remove dust, dirt, debris or any other foreign materials.

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

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

1. Test units for proper function and adjust until proper operation is achieved.
2. Repair finishes damaged during installation.
3. Restore finishes so no evidence remains of corrective work.

B. Where floors, walls, or ceilings must be penetrated for access to mechanical, plumbing or electrical equipment, provide access doors, 14 inch by 14 inch minimum size in usable opening. Where entrance of a serviceman may be required, provide 20 inch by 30 inch minimum usable opening. Locate access doors/panels for non-obstructed and easy reach.

C. All access doors less than 7'-0" above floors and exposed to public access shall have keyed locks.

D. Provide stainless steel access doors for use in toilet rooms, shower rooms, kitchens and other damp areas. Provide steel access doors with prime coat of baked-on paint for all other areas.

E. Do not locate access doors in highly visible public areas such as lobbies, waiting areas, and primary entrance areas. Coordinate with the Architect when access is required in these areas.

F. Furnish and install access doors wherever required whether shown or not for easy maintenance of mechanical, plumbing or electrical systems; for example, at concealed valves, strainers, traps, cleanouts, dampers, motors, controls, operating equipment, etc. Access doors shall provide for complete removal and replacement of equipment.

3.3 ADJUSTING AND CLEANING

A. Adjust doors and hardware, after installation, for proper operation.

B. Remove and replace access doors with damage, bowing, or warping that interferes with the installation or functionality of product. Dispose of damaged material in accordance with all governmental regulations.

C. Clean exposed surfaces using methods acceptable to the manufacturer which will not damage finish.

D. Protect completed work from subsequent construction activities as recommended by manufacturer.

END OF SECTION 083113

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Aluminum-framed storefront systems.
2. Aluminum-framed entrance door systems.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:

a. Joinery, including concealed welds.
b. Anchorage.
c. Expansion provisions.
d. Glazing.
e. Flashing and drainage.

3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

4. Include point-to-point wiring diagrams showing the following:

    a. Power requirements for each electrically operated door hardware.
    b. Location and types of switches, signal device, conduit sizes, and number and size of wires.

5. For each different type of extrusion used, submit fully dimensioned cross-sectional diagrams, including thickness of legs, webs, and flanges.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

E. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch (300-mm) lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

F. Entrance Door Hardware Schedule: Refer to Section 087111 “Door Hardware” for hardware groups at aluminum storefront entrances.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For Installer and field testing agency.

2. For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the state in which Project is located.

B. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Source quality-control reports.

D. Field quality-control reports.

E. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer and that employs a qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors.

B. Testing Agency Qualifications: Qualified according to ASTM E699 for testing indicated and acceptable to Owner and Architect.

C. Egress Door Inspector Qualifications:

1. Inspector for field quality-control inspections of egress door assemblies to comply with qualifications set forth in NFPA 101, Ch. 7 "Means of Egress," Section "Means of Egress Components," Article "Inspection of Door Openings."
2. Inspector for field quality-control inspections of egress door assemblies to be certified under DHI's certification program as a Fire and Egress Door Assembly Inspector (FDAI) or a Certified Fire and Egress Door Assembly Inspector (CFDAI).

D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including, but not limited to, excessive deflection.
b. Noise or vibration created by wind and thermal and structural movements.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

d. Water penetration through fixed glazing and framing areas.
e. Failure of operating components.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 10 years from date of Substantial Completion.

C. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, peeling, or chipping.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing spandrel panels, venting windows and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.

2. Failure also includes the following:

    a. Thermal stresses transferring to building structure.
    b. Glass breakage.
    c. Noise or vibration created by wind and thermal and structural movements.
    d. Loosening or weakening of fasteners, attachments, and other components.
    e. Failure of operating units.

B. Deflection of Framing Members Supporting Glass: At design wind load, as follows:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m).
2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch (3.2 mm).

C. Structural: Test according to ASTM E330/E330M as follows:

1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

D. Water Penetration under Static Pressure: Test according to ASTM E331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).
2. Maximum Water Leakage: According to AAMA 501.1. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.

E. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.6 at design displacement and 1.5 times the design displacement.

F. Energy Performance: Certified and labeled with NFRC certification by manufacturer for energy performance as follows:

1. Thermal Transmittance (U-factor):

a. Fixed Glazing and Framing Areas:

1) Climate Zones 2-6, 8-16: U-factor for the system of not more than 0.41 Btu/sq. ft. x h x deg F as determined according to NFRC 100.

b. Entrance Doors: U-factor of not more than 0.45 Btu/sq. ft. x h x deg F as determined according to NFRC 100.

2. Solar Heat-Gain Coefficient (SHGC):

a. Fixed Glazing and Framing Areas:

1) Climate Zones 2-6, 8-16: RSHGC for the system of not more than 0.26 as determined according to NFRC 200.

b. Entrance Doors: SHGC of not more than 0.23 determined according to NFRC 200.

3. Air Leakage:

a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.03 cfm/sq. ft. (0.15 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa) when tested according to ASTM E283.
b. Entrance Doors: Air leakage of not more than 1.0 cfm/sq. ft. (5.08 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).

G. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.3 STOREFRONT SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Arcadia, Inc.
2. Kawneer North America, an Arconic company. Trifab VG 451T
3. U.S. Aluminum; a brand of C.R. Laurence.
4. Or approved equal

B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Interior Vestibule Framing Construction: Nonthermal.
2. Glazing System: Retained mechanically with gaskets on two sides and structural sealant on two sides.
3. Glazing Plane: Front.

4. Finish: Clear anodic finish.
5. Fabrication Method: Screw-spline.
6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
7. Steel Reinforcement: As required by manufacturer.

C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

E. Insulated Spandrel Panels:

1. Laminated, metal-faced flat panels with no deviations in plane exceeding 0.8 percent of panel dimension in width or length.

a. Overall Panel Thickness: 1 inch (25.4 mm).
b. Exterior Skin: Aluminum.

1) Thickness: <Insert thickness>.
2) Finish: Match framing system.
3) Texture: Smooth.
4) Backing Sheet: 1/8-inch- (3.2-mm-) thick tempered hardboard.

c. Interior Skin: Aluminum.

1) Thickness: Manufacturer's standard for finish and texture indicated.
2) Finish: Low-gloss, white baked enamel.
3) Texture: Smooth.
4) Backing Sheet: 1/8-inch- (3.2-mm-) thick tempered hardboard.

d. Thermal Insulation Core: Manufacturer's standard rigid, closed-cell, polyisocyanurate board.
e. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1) Flame-Spread Index: 25 or less.
2) Smoke-Developed Index: 50 or less.

2.4 ENTRANCE DOOR SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Arcadia, Inc.
2. Kawneer North America, an Arconic company. Insulpour Thermal Entrances

B. Entrance Doors: Manufacturer's thermal glazed entrance doors for manual-swing or automatic operation.

1. Door Construction: 1-3/4-inch (44.5-mm) overall thickness, with minimum 0.125-inch-(3.2-mm-) thick, extruded-aluminum tubular rail and stile members. Welded corners.
2. Door Design: Wide stile; 5-inch (127-mm) nominal width.
3. Thermal Construction: Manufacturer’s high-performance polypropylene gasket and polyurethane system to separate aluminum members exposed to the exterior from members exposed to the interior.
4. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.

    a. Provide nonremovable glazing stops on outside of door.

5. Face Sheets: Aluminum

C. Doors are to be free of any Logo/Decal including Manufacturer’s Nameplate.

2.5 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087111 "Door Hardware."

2.6 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.
1. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.7 MATERIALS

A. Sheet and Plate: ASTM B209 (ASTM B209M).

B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221 (ASTM B221M).

1. Recycled Content: Shall have a minimum of 50% mixed pre- and post-consumer recycled content.

    a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
    b. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
    c. Indicate location recovery of recycled content.
    d. Indicate location of manufacturing facility.

C. Structural Profiles: ASTM B308/B308M.

2.8 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch (25.4 mm) that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

E. Rigid PVC Filler.

2.9 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At interior and exterior doors, provide compression weather stripping at fixed stops.

F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.10 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Seal perimeter and other joints watertight unless otherwise indicated.

G. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.

I. Install joint filler behind sealant as recommended by sealant manufacturer.

J. Install components plumb and true in alignment with established lines and grades.

3.3 INSTALLATION OF GLAZING

A. Install glazing as specified in Section 088000 "Glazing."

3.4 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE DOORS

A. Install entrance doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.5 ERECTION TOLERANCES

A. Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
2. Level: 1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
3. Alignment:

    a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
    b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).
    c. Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).

4. Location: Limit variation from plane to 1/8 inch in 12 feet (3.2 mm in 3.6 m); 1/2 inch (12.7 mm) over total length.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts.

1. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. (0.45 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).

    a. Perform a minimum of two tests in areas as directed by Architect.

2. Water Penetration: ASTM E1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft. (300 Pa), and shall not evidence water penetration.

C. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.7 ENTRANCE DOOR HARDWARE SETS

A. See Section 087111 “Door Hardware” for hardware sets.

END OF SECTION 084113

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Sections: The following sections are noted as containing requirements that relate to this Section, but may not be limited to this listing.

1. Division 08: Section - Hollow Metal Doors and Frames.
2. Division 08: Section - Flush Wood Doors.
3. Division 08: Section - Aluminum-Framed Entrances and Storefronts.

1.3 REFERENCES

A. 2022 California Building Code, CCR Title 24, Part 2

B. BHMA - Builders' Hardware Manufacturers Association

C. DHI - Door and Hardware Institute

D. NFPA - National Fire Protection Association.

1. NFPA 80 - Fire Doors and Other Opening Protectives
2. NFPA 105 - Smoke and Draft Control Door Assemblies

E. UL - Underwriters Laboratories.

1. UL 10C - Fire Tests of Door Assemblies
2. UL 305 - Panic Hardware

F. WHI - Warnock Hersey Incorporated

G. SDI - Steel Door Institute

1.4 SUBMITTALS & SUBSTITUTIONS

A. General: Submit in accordance with Conditions of the Contract and Division 01 Specification sections.

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

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

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

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

3. Vertical schedule format sample:

Heading Number 1 (Hardware group or set number - HW Group #1)				
(a) 1 Single - Door #101 - Corridor 101 to Exterior			(b) 90°	(c) RH
(d) 3'-0" x 7'-0" x 1-3/4" - Wood Door x Hollow Metal Frame - 20 Minute				
(e) 1.	(f) 3 ea	(g) Hinges - (h) 5BB1 4.5 x 4.5 NRP (i) 1/2 TMS	(j) 630	(k) IVE
2.	1 ea	Lockset - ND80P6D x RHO x RH x 10-025 x JTMS	626	SCH
3.	1 ea	Closer - 4040XP x EDA x TBSRT	689	LCN

(a) Single or pair of doors with opening number and location.
(b) Degree of opening.

(c) Hand of door(s).
(d) Door/frame dimensions and material; Label requirements, if any.
(e) Hardware item line # (Optional).
(f) Quantity.
(g) Product description.
(h) Product part number.
(i) Fastenings and other pertinent information.
(j) Hardware finish codes per ANSI/BHMA A156.18.
(k) Manufacturer abbreviation.

D. Make substitution requests in accordance with Division 01. Substitution requests must be made prior to bid date. Include product data and indicate benefit to the project. Furnish samples of any proposed substitution.

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

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

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

H. Fire Door Assembly Testing: Submit a written record of each fire door assembly to the District to be made available to the Authority Having Jurisdiction (AHJ) for future building inspections.

1.5 QUALITY ASSURANCE

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

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

1. Responsible for detailing, scheduling and ordering of finish hardware.
2. Meet with District to finalize keying requirements and to obtain final instructions in writing.
3. Stock parts for products supplied and are capable of repairing and replacing hardware items found defective within warranty periods.

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

D. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and tested by UL or Warnock Hersey for given type/size opening and degree of label. Provide proper latching hardware, door closers, approved-bearing hinges and seals whether listed in the Hardware Schedule or not.

1. Where emergency exit devices are required on fire-rated doors, (with supplementary marking on doors' UL labels indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL label on exit devices indicating "Fire Exit Hardware".

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

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

1.6 DELIVERY, STORAGE AND HANDLING

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

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

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

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

1.7 WARRANTY

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

1. Locksets: Ten (10) years.
2. Exit devices: Ten (10) years.
3. Closers: Thirty (30) years.
4. All other hardware: Two (2) years.

1.8 MAINTENANCE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for District's continued adjustment, maintenance, and removal and replacement of door hardware.

1.9 PRE-INSTALLATION CONFERENCE

A. Convene a pre-installation conference at least one week prior to beginning work of this section.

B. Attendance: Architect, Construction Manager, Contractor, Security Contractor, Hardware Supplier, Installer, Key District's Personnel, and Project Inspector.

C. Agenda: Review hardware schedule, products, installation procedures and coordination required with related work. Review District's keying standards.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

Item	Manufacturer	Acceptable Substitutes
Hinges	Ives	Hager, Stanley, McKinney
Locks, Latches & Cylinders	Schlage	None – District Standard
Exit Devices	Von Duprin	None – District Standard
Closers	LCN	None – District Standard
Protection Plates	Trimco	Ives
Door Stops	Trimco	Ives
Overhead Stops	Glynn-Johnson	Or Approved Equal
Seals, Bottoms & Thresholds	Zero	Pemko, NGP

2.2 MATERIALS

A. Hinges:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. Hinges shall be sized in accordance with the following:
   a. Height:
      1) Doors up to 42" wide: 4-1/2 inches.
      2) Doors 43" to 48" wide: 5 inches.
   b. Width: Sufficient to clear frame and trim when door swings 180 degrees.
   c. Number of Hinges: Provide 3 hinges per leaf to 7'-5" in height. Add one for each additional 2 feet in height.

3. Exterior out-swinging hinges shall be non-ferrous material and shall have stainless steel hinge pins. All doors to have non-rising pins.
4. Furnish non-removable pins (NRP) at all exterior out-swing doors and interior key lock doors with reverse bevels.

B. Continuous Hinges:

1. Provide aluminum geared continuous hinges fabricated from 6063-T6 aluminum conforming to ANSI/BHMA A156.26, Grade 1.
2. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
3. Provide continuous hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
4. Provide continuous hinges 1" shorter in length than nominal height of door, unless otherwise noted, with symmetrical hole pattern.
5. Install continuous hinges with fasteners supplied by manufacturer.

C. Heavy Duty Cylindrical Locks and Latches: Schlage "ND" Series as scheduled with "Sparta" lever design.

1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3 hour fire doors.
2. Provide cylindrical locksets exceeding the ANSI/BHMA A156.2 Grade 1 performance standards for strength, security, and durability in the categories below:
    a. Abusive locked lever torque – minimum 3,100 inch-pounds without gaining access.
    b. Offset lever pull – minimum 1,600 foot pounds without gaining access.
    c. Vertical lever impact – minimum 100 impacts without gaining access.
    d. Cycle Test – tested to minimum 16 million cycles with no visible lever sag; without the use of performance aids such as set screws or spacers.
3. Cylinders: Refer to "KEYING" article, herein.
4. Provide locks with standard 2-3/4" backset, unless noted otherwise, with 1/2" latch throw. Provide proper latch throw for UL listing at pairs.
5. Provide locksets with separate solid steel anti-rotation thru-bolts, and no exposed screws.
6. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
7. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
8. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.
9. Provide levers with vandal resistant technology as scheduled for use at abusive applications.
10. Indicators: Where specified, provide visual lock status indicators built-into lockset rose escutcheon.

D. Heavy Duty Mortise Locks and Latches: Schlage "L" Series as scheduled with "17" style lever and "A" style rose.

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3 hour fire doors.
2. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
3. Provide lock case that is multi-function and field reversible for handing without opening case.
4. Provide locks with standard 2-3/4" backset with full 3/4" throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1" throw, constructed of stainless steel.
5. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.

6. Cylinders: Refer to “KEYING” article, herein.
7. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.
8. Provide levers with vandal resistant technology as scheduled for use at abusive applications.
9. Indicators: Where specified, provide indicator above cylinder or emergency release for visibility while operating the lock that identifies an occupied/unoccupied status of the lock or latch.

E. Exit devices: Von Duprin as scheduled.

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Provide certificate by independent testing laboratory that device has completed over 1,000,000 cycles and can still meet ANSI/BHMA A156.3 standards.
3. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
4. Provide exit devices cut to door width and height. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
5. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
6. Provide flush end caps for exit devices.
7. Exit devices shall comply with CBC Section 11B-404.2.7 and shall be mounted between 34" and 44" above the finished floor surface.
8. Provide exit devices UL certified to meet 5 lbs. maximum unlatching force requirements according to the CBC Section 11B-309.4.
9. Cylinders: Refer to “KEYING” article, herein.
10. Provide cylinder or hex-key dogging as specified at non fire-rated openings. Provide cylinder dogging indicators (CDSI) for visible indication of dogging status as specified.
11. Removable Mullions: Provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
12. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
13. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
14. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.
15. Provide exit devices with manufacturer’s approved strikes.

F. Closers: LCN 4040XP series as scheduled.

1. Door Closers to be compliant with CBC Section 11B-404.2.8.1.
2. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
3. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
4. Provide certificate by independent testing laboratory that door closers have completed over 10,000,000 cycles and can still meet ANSI/BHMA A156.4 standards.

5. Cylinder Body: 1-1/2” diameter with 3/4” diameter double heat-treated pinion journal.
6. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120° F to -30° F.
7. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
8. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
9. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
10. Pressure Relief Valve (PRV) Technology: Not permitted.
11. Provide door closers powder coated to match balance of door hardware. Powder coating finish shall be certified to exceed 100 hours salt spray testing as described in ANSI/BHMA A156.4 and ASTM B117.
12. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

G. Flush Bolts & Dust Proof Strikes:

1. Automatic flush bolts shall be of the low operating force design.
2. Provide top bolt only model for interior doors where applicable and as permitted by testing procedures.
3. Provide dust proof strikes at openings using bottom bolts.
4. Manual flush bolts shall only be permitted on storage or mechanical openings, as scheduled.

H. Door Stops:

1. Unless otherwise noted in hardware sets, provide floor or wall type with appropriate fasteners. Where neither floor or wall type can be used, provide overhead type.
2. Do not install floor stops more than four (4) inches from the face of the wall or partition (CBC Section 11B-307).
3. Provide backing plate at wall framing behind wall type.
4. Overhead stops shall be made of stainless steel and non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions. Stop-only function shall be provided at fire-rated openings.

I. Protection Plates:

1. Provide kick, mop, and/or armor plates minimum of 0.050” thick, with four beveled edges. Furnish with sheet metal or wood screws, finished to match plates.
2. Kick plates shall be sized 10" high and 2" less door width (LDW) at single doors and 10” high and 1” LDW at pairs or doors.
3. Provide mop and armor plates with sizes as scheduled in hardware sets.

J. Thresholds: As scheduled and per details.

1. Thresholds shall not exceed 1/2" in height, with a beveled surface of 1:2 maximum slope. Thresholds shall comply with CBC Section 11B-404.2.5.

2. Set thresholds in a full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements in Division 07 “Thermal and Moisture Protection”.
3. Use 1/4” fasteners, red-head flat-head sleeve anchors (SS/FHSL).

K. Seals: Provide silicone gasket at all rated and exterior doors.

1. Smoke & Draft Control Doors: Provide UL10C Classified complies with NFPA 80 & NFPA 252 for use on “S” labeled Positive Pressure door assemblies.

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

2.3 KEYING

A. Furnish a Proprietary Schlage Classic Primus 3G masterkey system as directed by the District. District shall preform all keying. Verify keyway with District Maintenance department. Furnish construction keying for doors requiring locking during construction.

B. Cylinders shall be provided directly to District locksmith prior to installation for keying and labelling. Cylinders shall be returned to the Contractor for installation.

C. Furnish all cylinders in the Schlage Full Size Interchangeable Core (FSIC) style. Pack change keys independently (PKI).

D. Furnish all key blanks as Schlage 35-053 standard bow (unembossed) with Primus logo on back side only.

E. Furnish all keys with visual key control.

1. Stamp key “Do Not Duplicate”.
2. Stamp (BHMA) key symbol on key.
3. Stamp unique owner identifier from the key bow.

F. Furnish minimum 2 keys for each cylinder and 2 control keys per order.

2.4 FINISHES

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

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

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

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

2.5 FASTENERS

A. Screws for strikes, face plates and similar items shall be flat head, countersunk type, provide machine screws for metal and standard wood screws for wood.

B. Screws for butt hinges shall be flathead, countersunk, full-thread type.

C. Fastening of closer bases or closer shoes to doors shall be by means of sex bolts and spray painted to match closer finish.

D. Provide expansion anchors for attaching hardware items to concrete or masonry.

E. All exposed fasteners shall have a phillips head.

F. Finish of exposed screws to match surface finish of hardware or other adjacent work.

G. All Exit Devices and Lock Protectors shall be fastened to the door by the means of sex bolts or through bolts.

PART 3 - EXECUTION

3.1 INSPECTION

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

B. Beginning of installation means acceptance of existing conditions.

C. Fire-Rated Door Assembly Inspection: Upon completion of the installation, all fire door assemblies shall be inspected to confirm proper operation of the closing device and latching device and that only the manufacturer’s furnished fasteners are used for installation and that it meets all criteria of a fire door assembly per NFPA 80 (Standard for Fire Doors and Other Opening Protectives). A written record shall be maintained and transmitted to the District to be made available to the Authority Having Jurisdiction (AHJ). The inspection of the swinging fire doors shall be performed by a certified FDAI (Fire Door Assembly Inspector) with knowledge and understanding of the operating components of the type of door being subjected to the inspection. The record shall list each fire door assembly throughout the project and include each door number, an itemized list of hardware set components at each door opening, and each door location in the facility.

3.2 INSTALLATION

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

B. Use the templates provided by hardware item manufacturer.

C. Mounting heights for hardware shall be as recommended by DHI. Operating hardware shall be located between 34" and 44" above finish floor to comply with CBC Section 11B-404.2.7.

D. Door Closers:

1. Place door closers inside building, stairs, rooms, etc. Closers shall be installed to permit doors to swing 180 degrees or maximum allowable by conditions.
2. Maximum effort to operate closers shall not exceed 5 lbs., such pull or push effort being applied at right angles to hinged doors.
3. When fire doors are required, the maximum effort to operate the closer may be increased but shall not exceed 15 lbs. when specifically approved by fire marshal.
4. All closers shall be adjusted to operate with the minimum amount of opening force and still close and latch the door. These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position.
5. Compensating devices or automatic door operators may be utilized to meet the above standards.
6. Per CBC Section 11B-404.2.8.1, doors shall take minimum of 5 seconds to move from an open position of 90 degrees to 12 degrees to the latch jamb.

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

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

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

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

3.3 ADJUST AND CLEAN

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

B. Clean adjacent surface soiled by hardware installation.

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

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

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

3.4 HARDWARE LOCATIONS

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

3.5 FIELD QUALITY CONTROL

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

3.6 HARDWARE SCHEDULE

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

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

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

MANUFACTURERS ABBREVIATIONS

GLY	=	Glynn-Johnson	Overhead Stops
IVE	=	Ives	Hinges
LCN	=	LCN	Door Closers
SCH	=	Schlage Lock	Locks, Latches & Cylinders
TRM	=	Trimco	Door Stops & Kick Plates
VON	=	Von Duprin	Exit Devices
ZER	=	Zero International	Gasketing, Seals & Thresholds

HW GROUP NO. 01

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	PANIC HARDWARE	CDSI-PA-AX-99-L-KC-17	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	26-091 ICX XQ11-948	626	SCH
2	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW B4E-CS	630	TRM
1	EA	FLOOR STOP/HOLDER	1267	626	TRM
1	EA	WEATHERSTRIP/SEALS	BY ALUM STOREFRONT MFR		
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO. 02

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	VANDL CLASSROOM SEC	ND98TD SPA IS-CRS	626	SCH
2	EA	PRIMUS CORE	20-740	626	SCH
1	EA	OH STOP & HOLDER	100H ADJ	630	GLY
1	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW B4E-CS	630	TRM
1	EA	WEATHERSTRIP/SEALS	BY ALUM STOREFRONT MFR		
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO. 03

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	VANDL CLASSROOM SEC	ND98TD SPA IS-CRS	626	SCH
2	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW B4E-CS	630	TRM
1	EA	FLOOR STOP/HOLDER	1267	626	TRM
1	EA	WEATHERSTRIP/SEALS	BY ALUM STOREFRONT MFR		
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO. 04

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	630	IVE
1	EA	MORTISE PRIVACY W/ INDICATOR	LV9056T 17A L583-363 OS-OCC	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP TBSRT	689	LCN
1	EA	WALL STOP	1270CV	626	TRM
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SHOE	153A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO. 05

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	MORTISE PRIVACY W/ INDICATOR	LV9056T 17A L583-363 OS-OCC	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW B4E-CS	630	TRM
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO. 06

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	VANDL STOREROOM LOCK	ND96TD SPA	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP SHCUSH TBSRT	689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW B4E-CS	630	TRM
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO. 07

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PANIC HARDWARE	CDSI-PA-AX-99-L-KC-17	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	26-091 ICX XQ11-948	626	SCH
2	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW B4E-CS	630	TRM
1	EA	FLOOR STOP	1211	626	TRM
1	EA	GASKETING	188SBK PSA	BK	ZER

HW GROUP NO. 08

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	VANDL CLASSROOM SEC	ND98TD SPA IS-CRS	626	SCH
2	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA TBSRT	689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW B4E-CS	630	TRM
1	EA	FLOOR STOP	1211	626	TRM
1	EA	GASKETING	188SBK PSA	BK	ZER

HW GROUP NO. 09

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	VANDL OFFICE LOCK	ND91TD SPA	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	KICK PLATE	K0050 10" X 2" LDW B4E-CS	630	TRM
1	EA	FLOOR STOP	1211	626	TRM
1	EA	GASKETING	188SBK PSA	BK	ZER

HW GROUP NO. 10

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	DBL CYL STORE LOCK	ND66TD SPA	626	SCH
2	EA	PRIMUS CORE	20-740	626	SCH
1	EA	KICK PLATE	K0050 10" X 2" LDW B4E-CS	630	TRM
1	EA	FLOOR STOP	1211	626	TRM
1	EA	GASKETING	188SBK PSA	BK	ZER

HW GROUP NO. 11

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CORRIDOR LOCK W/ IND	ND73TD SPA OS-OCC	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
			REUSE BALANCE OF EXISTING HARDWARE		

HW GROUP: GATE - SINGLE, TUBE STEEL, PANIC

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE AND CLOSER	SURECLOSE PIVOT (2) 57/108 AT 90W (1) SM AT 90W		D&D TECHNOLOGIES
1	EA	EXIT DEVICE	CD 99-AX-L X 360L	626	VON
1	EA	RIM CYLINDER	20-002	626	SCH
1	EA	KICK PLATE	8400 10” X 2” LDW	630	IVE

END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Glass products.
2. Insulating glass.
3. Glazing sealants.
4. Glazing tapes.
5. Miscellaneous glazing materials.

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

C. IBC: International Building Code.

D. CBC: California Building Code

E. Interspace: Space between lites of an insulating-glass unit.

F. Sealed Insulating Glass Unit Surface Designations:

1. Surface 1 - Exterior surface of the outer glass lite.
2. Surface 2 - Interspace surface of the outer glass lite.
3. Surface 3 - Interspace surface of the inner glass lite.
4. Surface 4 - Interior surface of the inner glass lite.

1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review temporary protection requirements for glazing during and after installation.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of the following products; 12 inches (300 mm) square.

1. Tinted glass.
2. Coated glass.
3. Insulating glass.

C. Glazing Accessory Samples: For sealants, in 12-inch (300-mm) lengths. Install sealant Samples between two strips of material representative in color of adjoining framing system.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer manufacturers of fabricated glass units glass testing agency and sealant testing agency.

B. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.

C. Product Test Reports: For fabricated glass and glazing sealants, for tests performed by a qualified testing agency and signed by manufacturers of glass and glazing products to certify that products furnishes comply with requirements.

1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
2. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.

D. Preconstruction adhesion and compatibility test report.

E. Sample Warranties: For special warranties.

1.8 QUALITY ASSURANCE

A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved by primary glass manufacturer.

B. Installer Qualifications: A qualified glazing contractor for this Project who employs glass installers for this Project who are certified under the National Glass Association Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers),

C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

E. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Install glazing in mockups specified in Section 084113 "Aluminum-Framed Entrances and Storefronts" to match glazing systems required for Project, including glazing methods.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.

1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
2. Use ASTM C1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.

4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.11 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F (4.4 deg C).

1.12 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: 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 from date of Substantial Completion.

B. Manufacturer's Special Warranty for 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 obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturer's Special Warranty for Heat-Soaked Tempered Glass: Manufacturer agrees to replace heat-soaked tempered glass units that spontaneously break due to nickel sulfide (NiS) inclusions at a rate exceeding 0.3 percent (3/1000) within specified warranty period. Coverage for any other cause is excluded.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Glass: Obtain tinted and coated glass from single source from single manufacturer.

B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

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

B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:

1. Design Wind Pressures: As indicated on Drawings.

    a. Wind Design Data: As indicated on Drawings.
2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch (25 mm), whichever is less.
3. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.

C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites of thickness indicated.
2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
3. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).

4. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
5. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

E. Acoustic Performance:

1. Exterior Glazing: 35 STC.
2. Interior Glazing: 35 STC.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
3. FGIA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
4. FGIA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Comply with testing requirements in 16 CFR 1201 and, Fenestration and Glazing Industry Alliance ANSI Z97.1.. Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

1. Lites more than 9 sq ft (0.84 sq m) in area are required to be Category II materials.
2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sf (0.84 sq m) in area, provide glazing products that comply with Category II materials, and for lites 9 sf (0.84 sq m) or less in area, provide glazing products that comply with Category I or II materials.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:

1. Insulating Glass Certification Council.
2. Associated Laboratories, Inc.
3. Fenestration and Glazing Industry Alliance.

D. Thickness: Where glass thickness is indicated, it is a minimum and for detailing only. Provide glass that complies with performance requirements and is not less than thickness indicated. Select minimum glass thicknesses to comply with ASTM E 1300 and performance requirements.

1. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Guardian Glass
2. Pilkington North America.
3. Vitro Architectural Glass
4. Viracon

B. Clear Annealed Float Glass: ASTM C1036, Type I (transparent flat glass), Class 1 (clear), Quality-Q3.

C. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

D. Heat-Treated Float Glass: ASTM C1048, Type I (transparent flat glass); Quality-Q3; of class, kind and condition indicated.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
2. Provide Kind HS (heat-strengthened) float glass in place of annealed float glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
3. For uncoated glass, comply with requirements for Condition A.
4. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
5. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated or required.

E. Reflective and Low-E Sputter-Coated Float Glass: ASTM C1376, float glass with metallic-oxide or -nitride coating deposited by vacuum deposition process after manufacturer and complying with other requirements specified.

F. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace and complying with ASTM E 2188 / E 2189.

1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 2 "Performance Requirements" Article.
2. Provide Kind FT (fully tempered) glass lites where safety glass is indicated or required.
3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
4. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
5. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:

    a. Spacer Material: Aluminum with mill or clear anodic finish.
    b. Desiccant: Molecular sieve or silica gel, or blend of both.
    c. Corner Construction: Manufacturer's standard corner construction.

2.5 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Glazing Sealants for Fire-Rated Glazing Products: Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated.
4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.

B. Neutral-Curing Silicone Glazing Sealant, Class 100/50: Complying with ASTM C920, Type S, Grade NS, Use NT.

2.6 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.7 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by 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:

1. [**EPDM**] [**Silicone**] with Shore A durometer hardness of 85, plus or minus 5.
2. Type recommended in writing by sealant or glass manufacturer.

D. Spacers:

1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
2. Type recommended in writing by sealant or glass manufacturer.

E. Edge Blocks:

1. [**EPDM**] [**Silicone**] with Shore A durometer hardness per manufacturer's written instructions.
2. Type recommended in writing by sealant or glass manufacturer.

F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

G. Perimeter Insulation for Fire-Resistance-Rated Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.8 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

B. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch- (3-mm-) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant where indicated

G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into

glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 MONOLITHIC GLASS SCHEDULE

A. Clear Tempered Glass **Type A**: Fully tempered float glass.

1. Thickness: 1/4”

3.9 INSULATING GLASS SCHEDULE

A. Low-E-Coated, Clear Insulating Glass **Type B**:

1. Basis-of-Design Product: Vitro Architectural Glass; Solarban 70 (2) + Clear
2. Overall Unit Thickness: 1 inch (25 mm).
3. Minimum Thickness of Each Glass Lite: 1/4”
4. Outdoor Lite: Fully tempered float glass.
5. Interspace Content: 1/2” Air.
6. Indoor Lite: Fully tempered float glass.
7. Low-E Coating: Sputtered on second surface.

8. Visible Light Transmittance: 64 percent minimum.
9. NFRC U-Value (Nighttime Winter): 0.28
10. SGHC: 0.27
11. Shading Coefficient: 0.32
12. Exterior Reflectance: 13 percent

END OF SECTION 088000

SECTION 090561.13 - MOISTURE VAPOR EMISSION CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fluid-applied, resin-based, membrane-forming systems that control the moisture-vapor-emission rate of high-moisture, interior concrete to prepare it for the following types floor covering installation.

    a. Resilient Tile and Sheet
    b. Broadloom Carpet
    c. Thin-set Ceramic Tile and Stone Tile

2. Removal of existing floor coverings
3. Preparation of new and existing concrete floor slabs for installation of floor coverings
4. Testing of concrete floor slabs for moisture and alkalinity (pH)
5. Patching compound
6. Remedial floor coatings

1.3 DEFINITIONS

A. MVE: Moisture vapor emission.

B. MVER: Moisture vapor emission rate.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:

1. Moisture and alkalinity (pH) limits and test methods.
2. Manufacturer's required bond/compatibility test procedure

C. Testing Agency's Report:

1. Description of areas tested; include floor plans and photographs if helpful.
2. Summary of conditions encountered.
3. Moisture and alkalinity (pH) test reports.
4. Recommendations for remediation of unsatisfactory surfaces.
5. Submit report to Architect.
6. Submit report not more than two business days after conclusion of testing

D. Adhesive Bond and Compatibility Test Report

E. Copy of RFCI (RWP)

1.5 INFORMATIONAL SUBMITTALS

A. Visual Observation Report: For existing floor coverings to be removed

B. Qualification Data: For Installer, manufacturer and testing agency

C. Product Test Reports: For each MVE-control system, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Preinstallation testing reports.

E. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Employs factory-trained personnel who are available for consultation and Project-site inspection.

B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

C. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.

1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.

D. Contractor's Responsibility Relating to Independent Agency Testing:

1. Provide access for and cooperate with testing agency.
2. Confirm date of start of testing at least 10 days prior to actual start.
3. Allow at least 4 business days on site for testing agency activities.
4. Achieve and maintain specified ambient conditions.
5. Notify Architect when specified ambient conditions have been achieved and when testing will start.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating directions for storage and mixing with other components.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Comply with MVE-control system manufacturer's written instructions for substrate and ambient temperatures, humidity, ventilation, and other conditions affecting system installation.

1. Store system components in a temperature-controlled environment and protected from weather and at ambient temperature of not less than 65 deg F (18 deg C) and not more than 85 deg F (29.4 deg C) at least 48 hours before use.
2. Maintain ambient temperature and relative humidity in installation areas within range recommended in writing by MVE-control system manufacturer, but not less than 65 deg F (18 deg C) or more than 85 deg F (29.4 deg C) and not less than 40 or more than 60 percent relative humidity, for 48 hours before installation, during installation, and for 48 hours after installation unless longer period is recommended in writing by manufacturer.
3. Install MVE-control systems where concrete surface temperatures will remain a minimum of 5 deg F (3 deg C) higher than the dew point for ambient temperature and relative humidity conditions in installation areas for 48 hours before installation, during installation, and for 48 hours after installation unless longer period is recommended in writing by manufacturer.

B. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.

C. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. MVE-Control System Capabilities: Capable of suppressing MVE without failure where installed on concrete that exhibits the following conditions:

1. MVER: Maximum 25 lb of water/1000 sq. ft. (11.34 kg of water/92.9 sq. m) when tested according to ASTM F1869.
2. Relative Humidity: Maximum 100 percent when tested according to ASTM F2170-19a using in situ probes.

B. Water-Vapor Transmission: Through MVE-control system, maximum 0.06 perm (3.45 ng/Pa x s x sq. m) when tested according to ASTM E96/E96M.

C. Tensile Bond Strength: For MVE-control system, greater than 200 psi (1.38 MPa) with failure in the concrete according to ASTM D7234.

2.2 MVE-CONTROL SYSTEM

A. Products: Subject to compliance with requirements, provide one of the following:

1. ARDEX Americas; ARDEX MC™ RAPID One-Coat Moisture Control System For Concrete to Receive ARDEX Products.
2. Floor Seal Technology, Inc.; MES 100 Concrete Moisture Vapor Sealer
3. Or approved equal

B. MVE-Control System: ASTM F3010-18-qualified, fluid-applied, two-component, epoxy-resin, membrane-forming system; formulated for application on concrete substrates to reduce MVER to level required for installation of floor coverings indicated and acceptable to manufacturers of floor covering products indicated, including adhesives.

1. Substrate Primer: Provide MVE-control system manufacturer's concrete-substrate primer if required for system indicated by substrate conditions.
2. Cementitious Underlayment Primer: If required for subsequent installation of cementitious underlayment products, provide MVE-control system manufacturer's primer to ensure adhesion of products to MVE-control system.

2.3 ACCESSORIES

A. Patching and Leveling Material: Moisture-, mildew-, and alkali-resistant product recommended in writing by MVE-control system manufacturer and with minimum of 3000-psi (20.68-MPa) compressive strength after 28 days when tested according to ASTM C109/C109M.

B. Crack-Filling Material: Resin-based material recommended in writing by MVE-control system manufacturer for sealing concrete substrate crack repair.

C. Cementitious Underlayment: If required to maintain manufacturer's warranty, provide MVE-control system manufacturer's gypsum cement-based underlayment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of system indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Preinstallation Testing:

1. Testing Agency: Engage a qualified testing agency to perform tests.
2. Alkalinity Testing: Perform pH testing according to ASTM F710. Install MVE-control system in areas where pH readings are less than 7.0 and in areas where pH readings are greater than 8.5.
3. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. (304.8 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F1869. Install MVE-control system in locations where concrete substrate MVER exceeds 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
    b. Internal Relative Humidity Test: Using in situ probes, ASTM F2170. Install MVE-control system in locations where concrete substrates exhibit relative humidity level greater than 75 percent.

4. Tensile-Bond-Strength Testing: For typical locations indicated to receive installation of MVE-control system, install minimum 100-sq. ft. (9.29-sq. m) area of MVE-control system to prepared concrete substrate and test according to ASTM D7234.

    a. Proceed with installation only where tensile bond strength is greater than 200 psi (1.38 MPa) with failure in the concrete.

B. Concrete Substrates: Prepare and clean substrates according to MVE-control system manufacturer's written instructions to ensure adhesion of system to concrete.

1. Remove coatings and other substances that are incompatible with MVE-control system and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by MVE-control system manufacturer. Do not use solvents.
2. Provide concrete surface profile complying with ICRI 310.2R [**CSP 3**] by shot blasting using apparatus that abrades the concrete surface with shot, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
3. After shot blasting, repair damaged and deteriorated concrete according to MVE-control system manufacturer's written instructions.
4. Protect substrate voids and joints to prevent resins from flowing into or leaking through them.
5. Fill surface depressions and irregularities with patching and leveling material.
6. Fill surface cracks, grooves, control joints, and other nonmoving joints with crack-filling material.
7. Allow concrete to dry, undisturbed, for period recommended in writing by MVE-control system manufacturer after surface preparation, but not less than 24 hours.
8. Before installing MVE-control systems, broom sweep and vacuum prepared concrete.

C. Protect walls, floor openings, electrical openings, door frames, and other obstructions during installation.

3.3 INSTALLATION

A. Install MVE-control system according to ASTM F3010-18 and manufacturer's written instructions to produce a uniform, monolithic surface free of surface deficiencies such as pin holes, fish eyes, and voids.

1. Install primers as required to comply with manufacturer's written instructions.

B. Do not apply MVE-control system across substrate expansion, isolation, and other moving joints.

C. Apply system, including component coats if any, in thickness recommended in writing by MVE-control system manufacturer for MVER indicated by preinstallation testing.

D. Cure MVE-control system components according to manufacturer's written instructions. Prevent contamination or other damage during installation and curing processes.

E. After curing, examine MVE-control system for surface deficiencies. Repair surface deficiencies according to manufacturer's written instructions.

F. Install cementitious underlayment over cured membrane if required to maintain manufacturer's warranty and in thickness required to maintain the warranty.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform installation inspections.

B. Installation Inspections: Inspect substrate preparation and installation of system components to ensure compliance with manufacturer's written instructions and to ensure that a complete MVE-control system is installed without deficiencies.

1. Verify that surface preparation meets requirements.
2. Verify that component coats and complete MVE-control-system film thicknesses comply with manufacturer's written instructions.
3. Verify that MVE-control-system components and installation areas that evidence deficiencies are repaired according to manufacturer's written instructions.

C. MVE-control system will be considered defective if it does not pass inspections.

3.5 PROTECTION

A. Protect MVE-control system from damage, wear, dirt, dust, and other contaminants before floor covering installation. Use protective methods and materials, including temporary coverings, recommended in writing by MVE-control system manufacturer.

B. Do not allow subsequent preinstallation examination and testing for floor covering installation to damage, puncture, or otherwise compromise the MVE-control system membrane.

END OF SECTION 090561.13

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.
3. Texture finishes.

B. Related Requirements:
1. Section 079200 "Joint Sealants" for acoustical joint sealants installed in gypsum board assemblies.
2. Section 093013 “Ceramic Tiling” for ceramic tile installed over tile backing panels.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Gypsum wallboard.
2. Gypsum board, Type X.
3. Gypsum ceiling board.
4. Mold-resistant gypsum board.
5. Cementitious backer units.
6. Interior trim.
7. Joint treatment materials.
8. Sound-attenuation blankets.
9. Acoustical sealant.
10. Textured finishes.

B. Shop Drawings:

1. For surfaces greater than 30’-0” in any dimension, show location and installation of control and expansion joints including plans, elevations and details of components.

C. Samples: For the following products:

1. Textured Finishes: Manufacturer's standard size for each textured finish indicated and on same backing indicated for Work.

1.4 QUALITY ASSURANCE

A. Mockups: Build mockups of at least 100 sq. ft. (9 sq. m) in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Build mockups for the following:

a. Each level of gypsum board finish indicated for use in exposed locations.
b. Each texture finish indicated.

2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.

1.5 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

C. Verify ceiling and wall materials comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Gypsum Wallboard: ASTM C1396/C1396M.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Georgia-Pacific Gypsum LLC; ToughRock®
b. PABCO Gypsum;PABCO® Regular Gypsum Board.
c. USG Corporation; USG Sheetrock® Brand
d. Or approved equal.

2. Thickness: As indicated on Drawings.
3. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

B. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Georgia-Pacific Gypsum LLC; ToughRock® Fireguard X.
b. PABCO Gypsum; PABCO FLAME CURB®.
c. USG Corporation; USG Sheetrock® Brand Firecode® X
d. Or approved equal

2. Thickness: As indicated on Drawings.

3. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
4. Combustibility: Non-combustible gypsum core per ASTM E136.
5. Flame Spread per ASTM E84

    a. Flame Spread:15
    b. Smoke Developed: 0

C. Gypsum Ceiling Board: ASTM C1396/C1396M. Manufactured to be sag resistant.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Georgia-Pacific Gypsum LLC; ToughRock® Span 24® Ceiling Board
    b. PABCO Gypsum;PABCO® Interior Ceiling Board.
    c. USG Corporation; USG Sheetrock® Brand UltraLight Panels.
    d. Or approved equal

2. Thickness: As indicated on Drawings.
3. Long Edges: Tapered.
4. Humidified Deflection per ASTM C473, less than 5/16 inch.

D. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Georgia-Pacific Gypsum LLC; ToughRock Mold-Guard Gypsum Board.
    b. PABCO Gypsum; MOLD CURB® Plus; MOLD CURB® Plus Type X
    c. USG Corporation; USG Sheetrock® Brand Mold Tough® Gypsum Panels.

2. Core: As indicated.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D3273, score of 10.
5. Water Absorption: ASTM C473, less than 5% by weight.
6. Application: Provide in moisture and humidity-prone areas like restrooms and kitchens.

2.4 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. CertainTeed; SAINT-GOBAIN; FiberCement BackerBoard.
    b. PermaBASE Building Products, LLC provided by National Gypsum Company; PermaBASE® Cement Board.
    c. USG Corporation; USG Durock® Brand Cement Board.

2. Thickness: As indicated on Drawings.
3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:

a. Cornerbead.
b. Bullnose bead.
c. LC-Bead: J-shaped; exposed long flange receives joint compound.
d. L-Bead: L-shaped; exposed long flange receives joint compound.
e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
f. Expansion (control) joint.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels:

1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.7 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. *9+-Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

C. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

D. Acoustical Sealant:

1. Products: Subject to compliance with requirements, provide products by one of the following:

a. Acoustical Sealant for Exposed and Concealed Joints: Nonsa, paintable, nonstaining latex sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1) Pecora Corp; AC-20 FTR Acoustical and Insulation Sealant.
2) United States Gypsum Co.; SHEETROCK Acoustical Sealant.

b. Acoustical Sealant for Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

1) OSI Sealants, Inc.; Pro-Series SC-170 Rubber Base Sound Sealant
2) OSI Sealants, Inc.; Pro-Series SC-175 Rubber Base Sounds Sealant
3) Pecora Corp,; BA-98
4) Tremco, Inc.; Tremco Acoustical Sealant

2.8 TEXTURE FINISHES

A. Primer: As recommended by textured finish manufacturer.

B. Non-Aggregate Finish: Premixed, vinyl texture finish for spray application.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corporation; Saint-Gobain North America; ProRoc Easi-Tex Spray Texture.
b. National Gypsum Company; ProForm® Quick Set™ Compound, Setting Type.
c. USG Corporation; BEADEX FasTex Wall and Ceiling Spray Texture.
d. Or approved equal

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

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

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
2. Fit gypsum panels around ducts, pipes, and conduits.

3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.

J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Wallboard Type: As indicated on Drawings.
2. Type X: As indicated on Drawings.
3. Ceiling Type: As indicated on Drawings.
4. Mold-Resistant Type: As indicated on Drawings.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 INSTALLATION OF TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLATION OF TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints at locations indicated on Drawings.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners unless otherwise indicated.
2. Bullnose Bead: Use where indicated.
3. LC-Bead: Use at exposed panel edges.
4. L-Bead: Use where indicated.
5. U-Bead: Use where indicated.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840 and GA-214-2021 “Levels of Finish for Gypsum Panel Products”:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile, acoustical tile and tackable wall covering.
3. Level 3: At substrates indicated to receive heavy duty/commercial grade wall coverings.
4. Level 4: At panel surfaces that will be exposed to view or have a final finish of vinyl wall covering, laminate wall covering and light textures.

    a. Primer and its application to surfaces are specified in Section 099124 "Interior Painting."
    a. Texture: Orange peel**.**

5. Level 5: At panels surfaces that will be exposed to view with a smooth finish, and at kitchens, food prep areas, restrooms and substrates to receive dry erase coatings.

    a. Primer and its application to surfaces are specified in Section 099124 "Interior Painting."

    a. Texture: Smooth.

E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 INSTALLATION OF TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture free of starved spots or other evidence of thin application or of application patterns.

C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written instructions.

3.8 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Porcelain tile.
2. Glazed wall tile.
3. Mortar beds and rendering materials
4. Surface preparation materials
5. Setting materials
6. Waterproof membrane.
7. Crack isolation membrane.
8. Grout materials
9. Flexible sealant.
10. Tile and grout sealers.
11. Metal edge strips.
12. Tile and grout maintenance, cleaners and grout haze removers.

B. Related Requirements:
1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
2. Section 092900 "Gypsum Board" for cementitious backer units.

1.3 REFERENCES

A. American National Standards Institute (ANSI):

1. ANSI A108 Series/A118 Series – American National Standards for Installation of Ceramic Tile.
2. ANSI A137.1 – American National Standard for Ceramic Tile.
3. ANSI A138.1 – American National Standard Specifications for Green Squared Certification for Tiles and Installation Materials

B. ASTM International (ASTM):

1. ASTM F1869 – Standard test Method for Measuring Moisture Vapor-Emission Rate of Concrete Subfloor Using Anhydrous Chloride.
2. ASTM F2170 – standard Test Method for determining relative humidity in Concrete Floor Slabs Using in situ Probes.

C. TCNA (HB): Handbook for Ceramic Tile, Glass, and Stone Installations; Tile Council of North America.

D. International Organization for Standardization (ISO):

1. ISO 13007 – Ceramic Tiles – Grout and adhesives

1.4 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 and ANSI 137.2 apply to Work of this Section unless otherwise specified.

B. Face Size: Actual tile size, excluding spacer lugs.

C. Module Size: Actual tile size plus joint width indicated.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

B. Convene one week prior to commencing work of this section.

C. Require attendance of installation material manufacturer, tile supplier, tile installer and installers of related work. Review installation procedures and coordination required with related work.

D. Meeting agenda includes but is not limited to:

1. Tile and installation material compatibility.
2. Grouting procedure.
3. Maintenance and cleaning products and methods.
4. Surface preparation.

1.6 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical information for each type of product.

B. Shop Drawings: Show locations of each type of tile, tile pattern and color arrangement. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile

substrates and finished tile surfaces. Show perimeter conditions, junctions with dissimilar materials, thresholds, ceramic accessories and setting details.

C. Samples for Initial Selection: For tile, grout, and accessories involving color selection.

D. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.
2. Full-size units of each type of trim and accessory for each color and finish required.
3. Metal edge strips in 6-inch (150-mm) lengths.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Manufacturer's Certificates: Certify that products meet or exceed specified requirements. When applicable, submit a Master Grade Certificate signed by the manufacturer and the installer certifying that products meet or exceed the specified requirements of ANSI A137.1, ANSI A137.2, and/or ANSI A137.3.

C. Product Certificates: For each type of product.

D. Product Test Reports: For tile-setting and -grouting products and certified porcelain tile.

E. Installation Instructions: Manufacturer's printed instructions for each product.

F. Maintenance Data: Include recommended cleaning methods, cleaning materials, and maintenance coatings.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.9 QUALITY ASSURANCE

A. Installer Qualifications:

1. Engage an experienced installer who has completed tile installations similar in material, design, and extent to that indicated for this project and with a record of successful in-service performance. Installer to have a minimum of five years' experience.
2. Five-Star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.
3. Installer's supervisor for the project must hold the International Masonry Institute's Foreman Certification.
4. Installer employs Ceramic Tile Education Foundation Certified Installers or installers recognized by the U.S. Department of Labor as Journeyman Tile Layers.

1.10 MOCKUPS

A. Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of each type of floor tile installation.
2. Build mockup of each type of wall tile installation.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

C. Protect setting materials from freezing and overheating in accordance with manufacturer's instructions.

D. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

E. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

F. Store liquid materials in unopened containers and protected from freezing.

G. Do not use frozen materials unless specifically allowed by manufacturer.

H. Deliver and store materials on site at least 24 hours before work begins.

I. Provide heated and dry storage facilities on site.

1.12 FIELD CONDITIONS

A. Comply with requirements of referenced standards and recommendations of material manufacturers for environmental conditions before, during, and after installation.

B. Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations.

C. For interior applications:

1. Do not begin installation until building is completely enclosed and maintains temperature and humidity conditions consistent with "after occupancy" conditions for a minimum of 2 weeks.
2. Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations.
3. Vent temporary heaters to exterior to prevent damage to tilework from carbon dioxide build-up.
4. Maintain temperatures at not less than 50°F (10°C) in tiled areas during installation and for 7 days after completion, unless higher temperatures are required by referenced installation standards or manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Dynamic Coefficient of Friction: Tile on walkway surfaces shall meet or exceed the following values as determined by testing in conformance with ASTM C 1028.

1. Dry and Level Surfaces: DCOF Any
2. Wet and Level Surfaces: DCOF Minimum of >0.42.

2.2 MANUFACTURERS

A. Source Limitations for Tile: Obtain tile from single source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Ensure Single-Source Warranty Requirements and Compatibility of Products: Provide cleaners, sealing and maintenance products, tile grout, setting materials, underlayments, patching, leveling and rendering material, additives, accessories and factory-prepared dry-set mortars from the same manufacturer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:

1. Metal edge strips.

2.3 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:

1. As selected by Architect from manufacturer's full range.

D. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

E. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

2.4 PORCELAIN MOSAIC TILE – **CT-3**

A. Porcelain Mosaic Tile Type.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Daltile; a brand of Dal-Tile Corporation. Keystones Group 1
b. Or approved equal.

2. Certification: Porcelain tile certified by the Porcelain Tile Certification Agency.
3. Module Size: as indicated in drawings.
4. Thickness: 1/4 inch (6.4 mm).

5. Face: Plain with cushion edges.

6. Surface: Smooth, without abrasive admixture.
7. Dynamic Coefficient of Friction: Not less than 0.42
8. Tile Color and Pattern: As selected by Architect from manufacturer's full range.
9. Grout Color: As selected by Architect from manufacturer's full range.

2.5 GLAZED WALL TILE **CT-1 and CT-2**

A. Glazed Wall Tile Type:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Daltile; a brand of Dal-Tile Corporation.
   b. Or approved equal

2. Face Size: 3 inch by 6 inch.
3. Face Size Variation: Rectified.
4. Thickness: 5/16 inch (8 mm).
5. Tile Color and Pattern: As selected by Architect from manufacturer's full range.
6. Grout Color: As selected by Architect from manufacturer's full range.

7. Mounting: Factory, back mounted.

2.6 SURFACE PREPARATION MATERIALS

A. Trowelable Floor/Wall Patch and Render Mortar: Quick-setting, polymer-modified, fiber-reinforced, cementitious rendering, patching, ramping and leveling mortar. Can be applied from 1/8 inch to 1-1/4 inches (3 mm to 3.2 cm).

1. Products: Subject to compliance with requirements, provide one of the following:

   a. MAPEI, Planitop 330 Fast.
   b. Custom Building Products.
   c. Laticrete International, Inc.; Quick Cure Mortar Bed

B. Trowelable Concrete Floor Patch: High-Performance, Fast-Setting Cementitious Patching Compound. Can be applied at 1/16-inch to 1-1/2 inches (1.5 mm to 38 mm) neat and from 1-1/2 inches to 3 inches (38 mm to 76 mm) neat in areas no larger than 24 sq. ft. (2.23 m2).

1. Products: Subject to compliance with requirements, provide one of the following:

   a. MAPEI Corporation; Mapecem Quickpatch.
   b. Custom Building Products.
   c. Laticrete International, Inc.; L & M Duracrete

2.7 WATERPROOF AND CRACK-SUPPRESSION MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.10 and ANSI A118.12 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Flexible Polyethylene Sheet Membrane: Nonwoven, polypropylene fabric on both sides, used for both waterproofing and crack-isolation in interior/exterior residential and commercial applications, ANSI A118.10 and ANSI A118.12.

1. Products: Subject to compliance with requirements, provide one of the following products:

   a. MAPEI Corporation; Mapeguard WP 200.
   b. Custom Building Products.
   c. Laticrete International, Inc.; Hydroban Sheet Membrane

2. Furnish all accessories necessary to create a waterproof system, including, but not limited to: sealing tape, pre-formed inside corners and outside corners, pipe collars and valve collars.

C. Fluid-Applied Membrane: Advanced liquid-rubber; extremely quick-drying, premium waterproofing and crack-isolation membrane, IAPMO-listed, ANSI A118.10 and A118.12.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. MAPEI Corporation; Mapelastic AquaDefense with Reinforcing Fabric
   b. Custom Building Products.
   c. Laticrete International, Inc.; Hydroban

D. Cementitious-Binder-Based Membrane: Rapid-drying, two-component, waterproofing and crack-isolation membrane, suitable for steam showers, IAPMO-listed, ANSI A118.10 and ANSI A118.12.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. MAPEI Corporation; Mapelastic Turbo.
   b. Custom Building Products.

2.8 THINSET SETTING MATERIALS

A. Improved Modified Dry-Set Cement Bonding Mortar: ANSI A118.4E and ISO 13007 C2TEP1.

1. Products: Subject to compliance with requirements, provide one of the following products:

   a. MAPEI Corporation; Keraflex SG
   b. Custom Building Products.
   c. Laticrete International, Inc.; 254 Platinum

2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.

2.9 GROUT MATERIALS

A. High-Performance Tile Grout: ANSI A118.7 and ISO CG2WA.

1. Products: Subject to compliance with requirements, provide one of the following:

a. MAPEI Corporation; Ultracolor Plus FA
b. Custom Building Products.
c. Laticrete International, Inc.; Permacolor Grout

2.10 FLEXIBLE SEALANT

A. 100%-Silicone Sealant: Heavy-traffic expansion and movement joints, horizontal and vertical complying with ASTM standards; ASTM: Meets C920, Type S, Grade NS, Glass 25, Use T1, T2, NT, I, M, G, A and O, and conforms to C794 adhesion properties, (#23 clear meets ASTM C920, Type S, Grade NS, Class 50, use NT).

1. Products: Subject to compliance with requirements, provide one of the following:

a. MAPEI Corporation; Mapesil T
b. Custom Building Products.
c. Laticrete International, Inc.; Latasil

2.11 PENETRATING TILE, STONE AND GROUT SEALERS

A. Solvent-Based Penetrating Sealer: Natural-look, providing maximum protection against most common stains. For use on interior and exterior natural stone (marble, limestone, sandstone, slate, granite, travertine, etc.), unglazed porcelain and ceramic tiles, masonry, quarry tiles and cement grout. Can also be used as a pre-grouting sealer.

1. Products: Subject to compliance with requirements, provide one of the following:

a. MAPEI Corporation; UltraCare Penetrating SB Stone, Tile and Grout Sealer
b. Custom Building Products.
c. Laticrete International, Inc.; Stonetech Impregnator

B. Water-Based Penetrating Sealer: Premium, natural-look, providing maximum protection for interior and exterior natural stone (marble, limestone, sandstone, slate, granite, travertine, etc.), unglazed ceramic tile, masonry. Can also be used as a pre-grouting sealer

1. Products: Subject to compliance with requirements, provide one of the following:

a. MAPEI Corporation; UltraCare Penetrating Plus Stone, Tile and Grout Sealer
b. Custom Building Products.
c. Laticrete International, Inc.; Stonetech Bulletproof

C. Water-Based Penetrating Sealer: Provides protection against staining for use with sanded and unsanded cementitious grout joints. Can also be used as a pre-grouting sealer.

1. Products: Subject to compliance with requirements, provide one of the following:

a. MAPEI Corporation; UltraCare Grout Sealer
b. Custom Building Products.
c. Laticrete International, Inc.; Stonetech Heavy Duty Grout Sealer

2.12 MISCELLANEOUS MATERIALS

A. Temporary Protective Coating: Manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.

1. Products: Subject to compliance with requirements, provide one of the following:

a. MAPEI Corporation; UltraCare Concentrated Tile & Grout Release
b. Custom Building Products.
c. Laticrete International, Inc.; Stonetech Grout Release

B. Metal Flooring Transitions: Profile designed specifically for flooring applications; height to match tile and setting-bed thickness.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Schluter Systems L.P.

2. Description: cove-shape.
3. Material and Finish: aluminum, from manufacturer’s full range of standard colors.

C. Metal Edge Trim: Profile designed for wall terminations and edge protection.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Schluter Systems L.P., Jolly
b. Or approved equal.

2. Description: Square.
3. Terminations: End caps, Inside corners, Outside corners matching edge-protection profile.
4. Material and Finish: aluminum, from manufacturer’s full range of standard colors.

D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

E. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints that does not change color or appearance of grout.

1. Products: Subject to compliance with requirements, provide one of the following:

a. MAPEI Corporation; Ultracare Grout Sealer
b. Custom Building Products; Grout and Tile Sealer.

F. Joint Backing: ASTM D1056; round, closed cell polyethylene foam rod; oversized 25percent larger than joint width.

G. Bond Breaker Tape: Pressure sensitive tape recommended by sealant manufacturer to suit application. Apply to bottom of joints that are too shallow to receive foam backer rod.

2.13 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove coatings, including curing compounds or other coatings, that are incompatible with tile-setting materials.

B. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

C. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1 and is sloped 1/4 inch per foot (1:50) toward drains.

D. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

E. Substrate Flatness:

1. For tile shorter than 15 inches (381 mm), confirm that structure or substrate is limited to variation of 1/4 inch in 10 ft. (6.4 mm in 3 m) from the required plane, and no more than 1/16 inch in 12 inches (1.5 mm in 300 mm) when measured from tile surface high points.

F. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 INSTALLATION OF CERAMIC TILE SYSTEM

A. Install tile backing panels and treat joints in accordance with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

B. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate. Dry film thickness (DFT) must comply with manufacturer’s recommendations.

1. Apply waterproof membrane only in dry weather, when ambient and substrate temperatures are above 40ºF (4ºC).
2. Allow waterproof membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.

C. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.

1. Allow crack isolation membrane to cure before installing tile or setting materials over it.

D. Mix mortars and grouts to comply with "Referenced Standards" Article in the Evaluations and mortar and grout manufacturers' written instructions.

1. Add materials, water, and additives in accurate proportions.
2. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

E. Install tile in accordance with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of ANSI A108 series that are referenced in TCNA installation methods and specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
2. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
3. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
4. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
5. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

    a. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets, so joints between sheets are not apparent in finished Work.
    b. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
    c. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

6. Joint Widths: Unless otherwise indicated install tile with the following joint widths:

a. Porcelain Tile: 1/8 inch (3.2 mm).
b. Glazed Wall Tile: 1/16 inch (1.6 mm).

7. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

F. Expansion and control joints: Provide expansion and control joints in accordance with TCNA method EJ171. Install proper sealant and backing material (backer rod and/or bond breaker tape) per TCNA method EJ171. Sealant must not bond to backing material and only form a 2 sided bond. For above-ground installations, additional movement joints are required.

1. Form joints during installation of setting materials, mortar beds, and tile. Keep joints free of dirt, debris, and setting materials prior to filling with sealants.
2. Do not saw-cut joints after installing tiles.
3. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

G. Metal Flooring Transitions: Install [at locations indicated] [where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile] [where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated].

H. Metal Wall Trim: Install at locations indicated on Drawings.

I. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors in accordance with manufacturer's written instructions. As soon as sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.5 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Floors: Protect from all traffic for at least 72 hours after installation.

1. Do not step on floor for at least 24 hours; if traffic is unavoidable after that, use plywood stepping boards.
2. Protect from heavy traffic for at least 7 days after installation.
3. When fast-setting materials are used to allow faster occupancy, comply with the manufacturer's recommendations.

C. Walls: Protect from impact, vibration, and heavy hammering on adjacent and opposite walls for 14 days after installation.

D. Protect from freezing and total water immersion for at least 21 days after installation.

E. Protect installed tile work from damages by other trades and general abuse until substantial work completion and acceptance.

F. Refer to manufacturer of setting materials product data sheets for recommended protection.

G. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.6 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:

1. TCNA F122 and applicable requirements of ANSI A108 Series for the materials being used: Cementitious bond coat (thinset) bonded to concrete.

a. Ceramic Tile Type: Porcelain
b. Grout: High-performance sanded grout.
c. Cementitious Bond Coat: Improved modified dry-set mortar.
d. Waterproof/Crack Isolation Membrane: Flexible polyethylene sheet membrane.
e. Movement Joints: Types located on Drawings.

B. Interior Wall Installations, Solid Backing:

1. TCNA W244 and applicable requirements of ANSI A108 Series for the materials being used: Interior wall installation over cementitious backer board; thin-set mortar with waterproof membrane.

a. Ceramic Tile Type: Glazed

b. Grout: High-performance unsanded grout.
c. Thinset Mortar: Improved modified dry-set mortar.
d. Waterproof Membrane: Fluid-applied membrane per ANSI A118.10 and A118.12
e. Wall Render Mortar (as necessary): Quick-setting, polymer-modified, fiber-reinforced, cementitious mortar.
f. Vapor Retarder Membrane
g. Movement Joints: Types located on Drawings.

END OF SECTION 093013

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for interior ceilings.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Laboratory Test Reports: For ceiling products, indicating compliance with requirements for low-emitting materials.
3. Compliance Documentation: Demonstrating products as compliant with California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Samples: For each exposed product and for each color and texture specified, 6 inches (150 mm) in size.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Product Test Reports: For each acoustical panel ceiling, for tests performed by a qualified testing agency.

C. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

1.8 QUALITY ASSURANCE

A. Single Source Limitations:

1. Acoustical Ceiling Panel and Suspension System: Obtain through one source from a single manufacturer.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockup of typical ceiling area as shown on Drawings.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 WARRANTY

A. Warranty Period:

1. Acoustical Panels: Ten (10) years from date of substantial completion
2. Suspension: Ten (10) years from date of substantial completion
3. Ceiling System: Thirty (30) years from date of substantial completion

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.11 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Verify ceiling products comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and as modified by 2022 CBC Chapter 16A, Section 1617A1.21 and approved by DSA.

C. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A according to ASTM E1264.
2. Smoke-Developed Index: 50 or less.

2.3 ACOUSTICAL PANELS – **ACT-1**

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong Ceiling & Wall Solutions.

2. Or approved equal.

B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

C. Acoustical Panels Type : Painted Mineral Fiber

1. Basis of Design Product: Armstrong Fine Fissure 465 of 466
2. VOC Content: Certified as Low Emission by one of the following:

   a. GreenGuard Children and Schools; www.greenguard.org
   b. Product listing in the CHPS Low-Emitting Materials Product List

3. Size: 24” x 48”
4. Thickness: 3/4 inches
5. Composition: Mineral Fiber
6. Light Reflectance: 88%
7. Sound Absorption (NRC) Range: 0.55
8. Ceiling Attenuation Class (CAC): 35
9. Edge: Square
10. Surface Color: White
11. Suspension System: Standard

2.4 METAL SUSPENSION SYSTEM – STANDARD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong Ceiling & Wall Solutions. 15/16” Prelude XL
2. Or approved equal

B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C635/C635M and designated by type, structural classification, and finish indicated.

C. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 (Z90) coating designation; with prefinished 15/16-inch- (24-mm-) wide metal caps on flanges.

1. Structural Classification: Heavy-duty system as defined by ASTM C635

   a. Main runners, cross runners, splices, expansion devices and intersection connectors shall be designed to carry a mean ultimate load of not less than 180 lbs in compression and tension per ASTM E580 Section 5.1.2

2. End Condition of Cross Runners: butt-edge type.
3. Face Design: Flat, flush.

4. Cap Material: Hot-dipped galvanized steel.
5. Cap Finish: Painted in color as selected from manufacturer's full range.

2.5 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E488/E488M or ASTM E1512 as applicable, conducted by a qualified testing and inspecting agency.

    a. Type: Postinstalled expansion anchors.
    b. Corrosion Protection: Carbon-steel components zinc plated according to ASTM B633, Class SC 1 (mild) service condition.
    c. Post-installed anchors shall have a current Evaluation Report.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Ceiling wires shall be Class 1 zinc coated (galvanized) carbon steel conforming to ASTM A641. Wire shall be #12 gauge (0.106” diameter) with soft temper and minimum tensile strength = 70 ksi. The maximum allowable (ASD) tension load for wire meeting this specification is 500 lbs.

    a. For diagonal bracing wires: Four (4) turns of the wire within 1.5” will develop the wire allowable load.
    b. For hanger wires: Three (3) turns of the wire within 3” is assumed to develop no more than 50 % of wire allowable load.

2. Attachment of the bracing wires to the structure above and to the main runners shall be adequate for the load imposed. The weight shall be taken as not less than four (4) psf for calculating seismic forces.

C. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical panels in place during a seismic event.

D. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

E. Seismic Struts: Compression struts designed to accommodate seismic forces and as detailed in the plans and as follows:

1. The strut shall be sized to adequately resist the vertical component force induced by the ceiling bracing wires and have a maximum kl/r not to exceed 300.
2. The trust shall not be more than one (horizontal) in six (vertical) out of plumb.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong World Industries, Inc.
2. Or approved equal

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.

2.7 ACOUSTICAL SEALANT

A. Products: Subject to compliance with requirements, provide products by one of the following:

1. Acoustical Sealant for Exposed and Concealed Joints: Nonsa, paintable, nonstaining latex sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

    a. Pecora Corp; AC-20 FTR Acoustical and Insulation Sealant.
    b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.

2. Acoustical Sealant for Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

    a. OSI Sealants, Inc.; Pro-Series SC-170 Rubber Base Sound Sealant
    b. OSI Sealants, Inc.; Pro-Series SC-175 Rubber Base Sounds Sealant
    c. Pecora Corp,; BA-98
    d. Tremco, Inc.; Tremco Acoustical Sealant

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

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

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C636/C636M and Section 5.2 of ASTM E580, in accordance with the details indicated on the Drawings, and manufacturer's written instructions.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system. Separate all ceiling hanger and bracing wires at least (6) inches from all unbraced ducts, pipes, conduit, etc.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
3. Hanger wires that are more than one (horizontal) in six (vertical) out of plumb shall have counter-sloping wires. See ASTM C636.
4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns in three inches. Hanger wire loops shall be tightly wrapped and sharply bent to prevent any vertical movement or rotation of the member within the loop per ASTM E580 Section 5.2.7.2. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate

for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors that extend through forms into concrete.
7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
8. Do not attach hangers to steel deck tabs.
9. Provide #12 gauge hanger wires at the ends of all main and cross runners within eight (8) inches of the support or within one-fourth (1/4) of the length of the end tee, whichever is least, for the perimeter of the ceiling area. Perimeter wires are not required when the length of the end tee is eight (8) inches or less.
10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

C. Ceiling grid members shall be attached to two (2) adjacent walls per ASTM E580, Section 5.2.3. Ceiling grid members shall be at least 3/4 inch clear of other walls. If walls run diagonally to ceiling grid system runners, one end of main and cross runners should be free, and a minimum of 3/4 inch clear of wall.

D. The width of the perimeter supporting closure angle shall be not less than two (2) inches.

E. At the perimeter of the ceiling area, where main or cross runners are not connected to the adjacent wall, provide interconnection between the runners at the free end to prevent lateral spreading. A metal stabilizer shall be used and placed within eight (8) inches of the wall. Where the perpendicular distance from the wall to the first parallel runner is eight (8) inches or less, the stabilizer or #16 gauge wire is not required.

F. Secure bracing wires to ceiling suspension members and to supports with a minimum of four (4) tight turns within 1.5 inches.

1. The slope of bracing wires shall not exceed 45 degrees from the horizontal plane and wires shall be taut. Splices in bracing wires shall develop the wire allowable load.

G. Secure hanging wires to ceiling suspension members and to supports with a minimum of three (3) tight turns in three (3) inches. Hanger wire loops shall be tightly wrapped and sharply bent to prevent any vertical movement or rotation of the member within the loops.

1. Hanger wires that are more than one (horizontal) in six (vertical) out of plumb shall have counter-sloping wires.

H. Hanger and bracing wire anchorage to the structure shall be installed in such a manner that the direction of the anchorage aligns closely with the direction of the wire.

1. Post-installed anchors shall have a current Evaluation Report acceptable to authorities having jurisdiction.
2. Power actuated fasteners in concrete are not permitted for bracing wires.

I. Lateral Force Bracing Assembly Installation

1. Lateral force bracing assemblies consisting of a compression strut and four (4) #12 gauge splayed bracing wires oriented 90 degrees from each other are required for all ceiling areas.
2. There shall be a brace assembly a distance of not more than one-half (1/2) of the above spacing from each surrounding wall, expansion joint and at the edges of any ceiling vertical offset. For example, where the brace spacing is 8' x 12', the edge distance shall be 4 feet in the direction of the 8 foot spacing and 6 feet in the direction of the 12 foot spacing.

J. Expansion joints shall be provided in the ceiling at intersections of corridors and at junctions of corridors and lobbies or other similar areas.

K. For ceiling areas exceeding 2,500 square feet, a seismic separation joint shall be provided to divide the ceiling into areas not exceeding 2,500 square feet in accordance with ASTM E580, Section 5.2.9.

L. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

M. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

N. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.

1. Arrange directionally patterned acoustical panels as follows:

   a. As indicated on reflected ceiling plans.

2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
3. Install seismic clips in areas indicated; space according to panel manufacturer's written instructions unless otherwise indicated.

O. Ceiling Fixtures, Terminals and Devices:

1. All fixtures, terminals and other devices shall be mounted in a manner that will not compromise ceiling performance in accordance with Section 13.5.6.2.2 of ASCE 7 as amended by CBC Section 1617A.1.21 and ASTM E580 Sections 5.3 and 5.4.
2. Ceiling panels shall not support any light fixtures, air terminals or devices.
3. Penetrations through the ceiling for sprinkler heads and other similar devices that are not integrally tied to the ceiling system in the lateral direction shall have a two (2) inch oversized ring, sleeve or adapter through the ceiling tile to allow free movement of one (1) inch in all horizontal directions. Alternatively, per ASTM E580, Section 5.2.8.5, a flexible sprinkler hose fitting that can accommodate one (1) inch of ceiling movement shall be permitted to be used in lieu of the oversized ring, sleeve or adapter.
4. Slack safety wires shall be considered hanger wires for installation and testing requirements.

P. Light Fixtures

1. All light fixtures shall be positively attached to the ceiling suspension systems by mechanical means per California Electrical Code (CEC) Article 410.36 to resist a horizontal force equal to the weight of the fixture. A minimum of two screws or approved fasteners are required at each light fixture, per ASTM E580, Section 5.3.1.
2. Surface-mounted light fixtures shall be attached to the main runner with at least two positive clamping devices on each fixture. The clamping device shall completely surround the supporting ceiling runner and be made of steel with a minimum thickness of #14 gauge. Rotational spring catches do not comply. A #12 gauge slack safety wire shall be connected from each clamping device to the structure above. Provide additional supports when light fixtures are eight (8) feet or longer or exceed 56 lbs. Maximum spacing between supports shall not exceed eight (8) feet.
3. Light fixtures weighing less than or equal to 10 lbs. shall have a minimum of one (1) #12 gauge slack safety wire connected from the fixture housing to the structure above.
4. Light fixtures weighing greater than 10 lbs. but less than or equal to 56 lbs. may be supported directly on the ceiling runners, but they shall have a minimum of two (2) #12 gauge slack safety wires connected from the fixture housing at diagonal corners to the structure above.

    a. Exception. All light fixtures greater than two by four feet weighing less than 56 lbs. shall have a #12 gauge slack safety wire at each corner.

5. All light fixtures weighing greater than 56 lbs. shall be independently supported by not less than four (4) taut #12 gauge hanger wires (one at each corner) attached from the fixture housing to the structure above or other approved hangers. The four (4) taut #12 gauge wires or other approved hangers, including their attachment to the structure above, shall be capable of supporting four (4) times the weight of the fixture.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Periodic inspection during the installation of suspended ceiling grids according to ASCE/SEI 7.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Perform the following tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages and when installation of ceiling suspension systems on each floor has reached 20 percent completion, but no panels have been installed. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations of acoustical panel ceiling hangers show compliance with requirements.

1. Within each test area, testing agency will select one of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) of tension.
2. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

D. Acoustical panel ceiling hangers, anchors, and fasteners will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.5 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

1. Clean Armstrong CleanAssure Family Products as specified with CDC and EPA-approved disinfectants per manufacturers Disinfecting Guidelines recommendations

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Thermoset-rubber base.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings including the following:

1. Seaming plan.
2. Coving details.

C. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
3. Product Data: For adhesives, indicating VOC content.
4. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

D. Samples: For each exposed product and for each color and texture specified, not less than 12 inches (300 mm) long.

E. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer’s installation and maintenance instructions.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.6 DELIVERY, STORAGE, AND HANDLING

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

B. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.7 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive resilient products during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

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

C. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

1.8 WARRANTY

A. Manufacturer’s limited 5 year Commercial Warranty.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Verify base products comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Version 1.2 January 2017.

B. Indoor Air Quality: FloorScore Certified.

2.2 THERMOSET-RUBBER BASE – **B-1**

A. Products: Subject to compliance with requirements, provide one of the following:

1. Tarkett; BaseWorks Thermoset Rubber

B. Product Standard: ASTM F1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).

1. Testing:

a. Flexibility (ASTM F137): Will not crack, break, or show any signs of fatigue when bent around a 1/4" (6.4 mm) diameter cylinder.
b. Flammability (ASTM E-84): Class B rating with smoke density of 150 – 200
c. Heat Resistance (ASTM E648): Passes, Class I, .45 watts/cm2
d. Smoke Generation (ASTM E662): Maximum Specific Optical Density of 450 or less

2. Profile: Cove
3. Thickness: 0.125 inch (3.2 mm).
4. Height: 4 inches (102 mm).
5. Lengths: Coils in manufacturer's standard length.
6. Outside Corners: Job formed.
7. Inside Corners: Job formed.
8. Colors: As selected by Architect from manufacturer's full range

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

1. Verify adhesives have a VOC content of 50 g/L or less and 60 g/L or less for rubber stair treads.

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

D. Provide threshold of thickness and width as shown on the drawings.

E. Provide resilient edge strips of width shown on the drawings, of equal gauge to the flooring, heterogeneous vinyl or rubber composition, tapered or bullnose edge, with color to match or contrast with the flooring, or as selected by the Architect from standard colors available.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Job-Formed Corners: Install pre-mitered corners first. Seat the bottom of the wall base snugly to the floor on either side of the corner. Anaerobic adhesive (Super Glue) may be used to adhere the two mitered pieces together. This can eliminate any slight gapping. Butt straight pieces of maximum lengths on either side of the pre-mitered corners. Make sure heights of the corner returns and the straight base match up.

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.

    a. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length. Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from surfaces.
2. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096516 - RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Homogenous vinyl sheet flooring.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Safety Data Sheets (SDS) for adhesives, weld rod, moisture mitigation systems, primers, patching/leveling compounds, floor finishes and cleaning agents.

C. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

D. Shop Drawings: For each type of resilient sheet flooring.

1. Include sheet flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
2. Show details of special patterns.

E. Samples: For each exposed product and for each color, texture, and pattern specified, in manufacturer's standard size, but not less than 6-by-9-inch (150-by-230-mm) sections.

1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches (230 mm) long, of each color required.

F. Samples for Initial Selection: For each type of resilient sheet flooring indicated.

G. Samples for Verification: For each type of resilient sheet flooring, in manufacturer's standard size, but not less than 6-by-9-inch (150-by-230-mm) sections of each color, texture, and pattern required.

1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches (230 mm) long, of each color required.

H. Welded-Seam Samples: For seamless-installation technique indicated and for each resilient sheet flooring product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch (150-by-230-mm) Sample applied to a rigid backing and prepared by Installer for this Project.

I. Product Schedule: For resilient sheet flooring. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of resilient sheet flooring to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Resilient Sheet Flooring: Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, in roll form and in full roll width for each type, color, and pattern of flooring installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for resilient sheet flooring installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by resilient sheet flooring manufacturer for installation techniques required.

B. Environmental: FloorScore Certified.

1.8 MOCKUPS

A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Coordinate mockups in this Section with mockups specified in other Sections.

a. Size: Minimum 100 sq. ft. (9.3 sq. m) for each type, color, and pattern in locations directed by Architect.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store resilient sheet flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store rolls upright.

B. Store rolls standing upright; do not lay rolls down for long periods.

C. When more than one roll of a color is being installed, all material should be from the same batch and the rolls must be installed in consecutive order. If material from more than one batch is to be used, the job should be laid out so that different batch numbers are not installed side by side.

D. Flooring material and adhesive must be acclimated to the installation area for a minimum of 48 hours prior to installation at a temperature between 65 degrees F and 85 degrees F.

1.10 FIELD CONDITIONS

A. The permanent HVAC system must be on for 7 days prior to, during and after installation between 65 and 85 degrees Fahrenheit or 18 to 29 degrees Celsius as recommended by manufacturer.

B. Material and adhesive must be acclimated to the installation area for a minimum of 48 hours prior to installation.

C. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 85 deg F (29deg C).

D. Close spaces to traffic during resilient floor installation and 48 hours after completion.

E. Install resilient floor after other finishing operations, including painting, have been completed.

F. Protect all materials from the direct flow of heat from hot-air registers, radiators, or other heating fixtures and appliances.

1.11 WARRANTY

A. Resilient Flooring: Submit a written warranty executed by the manufacturer, agreeing to repair or replace resilient flooring that fails within the warranty period.

B. Limited Warranty Period:

1. Vinyl Homogenous Flooring: 15 years

C. The Limited Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient sheet flooring, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. Verify flooring products comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Version 1.2 January 2017.

2.2 HOMOGENOUS VINYL SHEET FLOORING – **RS-1**

A. Products: Subject to compliance with requirements, provide the following:

1. Tarkett, Inc.; Homogeneous Sheet; iQ Granit

2. Or approved equal.

B. Product Standard: ASTM F1913 without backing.

1. Testing:

a. Flexibility (ASTM F137) - Passes - 1 1/2” Mandrel - No Crack/Break
b. Static Load (ASTM F970) - Passes - Residual Indent ≤ 0.005”
c. Static Load (ASTM F970 mod.) - Passes - 2,000 PSI; Residual Indent ≤ 0.005”

d. Rolling Resistance/Caster Chair (ISO 4918) - 25,000 Cycles, No Significant Change
e. Short Term Residual Indentation (ASTM F1914/F1303) - Passes - Must be < 0.007”
f. Flooring Radiant Panel (ASTM E648) - Passes - Class 1; ≥ 0.45 watts/cm2
g. Smoke Density (ASTM E662) - Passes - ≤ 450
h. Slip Resistance (ASTM C1028, Dry) - Passes - ≥ 0.5 Leather; 0.6 Rubber
i. Acoustic IIC (ASTM E492) - 50 - 6” Concrete with Drop Ceiling
j. Acoustic STC (ASTM E90) - 63 - 6” Concrete with Drop Ceiling
k. Resistance to Light (ASTM F1515) - Passes - < 8 Delta E Color Change
l. Chemical Resistance (ASTM F925) - Passes - No More Than Slight Change
m. Resistance to Heat (ASTM F1514) - Passes - < 8 Delta E Color Change
n. Resistance to Mold/Mildew (ASTM G2 1/E2180) - Passes - No More Than Slight Change

2. Wear-Layer Thickness: 0.020” (0.5 mm) minimum for Commercial Use.
3. Overall Thickness: 2 mm min.

4. With flash cove.

C. Wearing Surface: Smooth.

D. Sheet Width: As standard with manufacturer.

E. Seamless-Installation Method:

1. Heat welded.
2. Direct Glue.

F. Cove height: 6 inch

G. Colors and Patterns: Match Architect's samples.

2.3 ADHESIVES

A. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit resilient sheet flooring and substrate conditions indicated.

1. Verify adhesives have a VOC content of 60 g/L or less.
2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient sheet flooring manufacturer for applications indicated.

B. Moisture Control (if needed): Manufacturer’s recommended moisture control products.

C. Primer: Manufacturer’s recommended primer.

D. Seamless-Installation Accessories:

1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.

a. Colors: Match flooring.

2. Chemical-Bonding Compound: Manufacturer's product for chemically bonding seams.

2.5 ACCESSORIES

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

B. Provide threshold of thickness and width as shown on the drawings.

C. Provide resilient edge strips of width shown on the drawings, of equal gauge to the flooring, homogeneous vinyl or rubber composition, tapered or bullnose edge, with color to match or contrast with the flooring, or as selected by the Architect from standard colors available.

D. Provide metal edge strips of width shown on the drawings and of required thickness to protect exposed edges of the flooring. Provide units of maximum available length to minimize the number of joints. Use butt-type metal edge strips for concealed anchorage, or overlap-type metal edge strips for exposed anchorage. Unless otherwise shown, provide strips made of extruded aluminum with a mill finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Examine subfloors prior to installation to determine that surfaces are smooth and free from cracks, holes, ridges, and other defects that might prevent adhesive bond or impair durability or appearance of the flooring material.
2. Inspect subfloors prior to installation to determine that surfaces are free from curing, sealing, parting and hardening compounds; residual adhesives; adhesive removers; and other foreign materials that might prevent adhesive bond. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.
3. Report conditions contrary to contract requirements that would prevent a proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.

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

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to resilient floor manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by resilient floor manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by resilient floor manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 7 or more than 10 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. (304.8 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
    b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Internal Relative Humidity value must not exceed 90% RH prior to installation.

C. Smooth concrete surfaces, removing rough areas, projections, ridges, and bumps, and filling low spots, control or construction joints, and other defects with cement-based underlayment as recommended by the flooring manufacturer.

D. Remove paint, varnish, oils, release agents, sealers, and waxes. Remove residual adhesives as recommended by the flooring manufacturer. Remove curing and hardening compounds not compatible with the adhesives used, as indicated by a bond test or by the compound manufacturer's recommendations for flooring. Avoid organic solvents.

E. Do not install resilient floor until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient floor and installation materials into spaces where they will be installed.

F. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor.

3.3 RESILIENT FLOOR INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient floor.

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

C. In hallways and small spaces, work lengthwise from one end.

D. Scribe, cut, and fit floor to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

1. If you cut the product into a fine point, it may delaminate. Use an ethyl cyanoacrylate-based super glue to fuse the points together. Clean all glue from the top surface immediately. Alcohol-based super glues may cause the vinyl to swell.

E. Extend resilient floor into toe spaces, door reveals, closets, and similar openings. Extend resilient floor to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor as marked on substrates. Use chalk or other nonpermanent marking device.

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

H. Roll the resilient flooring with a 3-section 100 lb. roller. Re-roll the floor within the working time of the adhesive. Continue to roll the floor throughout the working day to ensure a proper bond.

3.4 ACCESSORY INSTALLATION

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

B. Apply butt-type or overlap metal edge strips where shown on the drawings, before flooring installation. Secure units to the substrate, complying with the edge strip manufacturer's recommendations.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient floor.

B. Perform the following operations immediately after completing floor installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient floor from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

1. Do not use a plastic adhesive-based protection system.

D. Cover resilient floor until Substantial Completion.

END OF SECTION 096516

SECTION 096816 - SHEET CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Tufted carpet.

B. Related Requirements:

1. Section 024119 "Selective Demolition" for removing existing floor coverings.
2. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to carpet installation including, but not limited to, the following:

a. Review delivery, storage, and handling procedures.
b. Review ambient conditions and ventilation procedures.
c. Review subfloor preparation procedures.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics and durability.
2. Include manufacturer's written installation recommendations for each type of substrate.

B. Sustainable Design Submittals:

1. Certificate showing compliance with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Version 1.2 January 2017.
1. Green Label Plus Certified
2. Cradle to Cradle Certified Gold
3. NSF 140 Gold Certification

C. Shop Drawings: For carpet installation, showing the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
2. Carpet type, color, and dye lot.
3. Locations where dye lot changes occur.
4. Seam locations, types, and methods.
5. Type of subfloor.
6. Type of installation.
7. Pattern type, repeat size, location, direction, and starting point.
8. Pile direction.
9. Types, colors, and locations of insets and borders.
10. Types, colors, and locations of edge, transition, and other accessory strips.
11. Transition details to other flooring materials.
12. Type of carpet cushion.

D. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet: 12-inch- (300-mm-) square Sample.
2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- (300-mm-) long Samples.
3. Carpet Seam: 6-inch (150-mm) Sample.

E. Samples for Initial Selection: For each type of product.

1. Include Samples of exposed edge, transition, and other accessory stripping involving color or finish selection.

F. Samples for Verification: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet: 12-inch- (300-mm-) square Sample.
2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- (300-mm-) long Samples.
3. Carpet Seam: 6-inch (150-mm) Sample.

4. Mitered Carpet-Border Seam: 12-inch- (300-mm-) square Sample. Show carpet pattern alignment.

G. Product Schedule: For carpet. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For carpet, for tests performed by a qualified testing agency.

C. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet: Full-width rolls equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II or Master II certification level.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockups at locations and in sizes shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Comply with the Carpet and Rug Institute's CRI 104.

B. Deliver carpet in original mill protective covering with mill register numbers and tags attached.

1.10 FIELD CONDITIONS

A. Comply with the Carpet and Rug Institute's CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

C. Do not install carpet over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.11 WARRANTY

A. Special Warranty for Carpet: Manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, the following:

a. More than 10 percent loss of face fiber, edge raveling, snags, and runs.
b. Loss of tuft bind strength.
c. Excess static discharge**.**
d. Delamination.

3. Warranty Period: 10 years from date of Substantial Completion.

B. Special Warranty for Carpet Cushion: Manufacturer agrees to repair or replace components of carpet cushion installation that fail in materials or workmanship within specified warranty period.

1. Warranty includes removal and replacement of carpet and accessories required by replacement of carpet cushion.
2. Warranty does not include deterioration or failure of carpet cushion due to unusual traffic, failure of substrate, vandalism, or abuse.
3. Failure includes, but is not limited to, permanent indentation or compression.

4. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TUFTED CARPET – **CPT-1**

A. Product: Tarkett, Aftermath II #03026

B. Color: As selected by Architect from manufacturer's full range.

C. Fiber Type: Dynex SD® Nylon/Dynex® Nylon

D. Pile Characteristic: Stratatec Patterned Loop

E. Density: 7,556 oz./cu. yd.

F. Pile Thickness: 0.081 inch

G. Stitches: 8.5 per inch

H. Gage: 5/64 per inch

I. Face Weight: 17 oz./sq. yd.

J. Primary Backing: Manufacturer's standard material.

K. Secondary Backing: Manufacturer's standard material.

L. Backcoating: Manufacturer's standard material.

M. Backing System: Powerbond Cushion

N. Roll Width: 72 inch .

O. Applied Treatments:

1. Applied Soil-Resistance Treatment: Manufacturer's standard material.
2. Antimicrobial Treatment: Manufacturer's standard material.

a. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.

P. Performance Characteristics:
1. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm according to NFPA 253.
2. Dry Breaking Strength: Not less than 100 lbf (445 N) according to ASTM D2646.

3. Delamination: No deamination per ASTM D3936.
4. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.

2.2 TUFTED CARPET – **CPT-2 and CPT-3**

A. Product: Tarkett, Abrasive Action II #02578

B. Color: As selected by Architect from manufacturer's full range.

C. Fiber Type: TDX Dynex

D. Pile Characteristic: Accuweave Patterned Loop

E. Density: 7,513 oz./cu. yd.

F. Pile Thickness: 0.115 inch

G. Stitches: 8.0 per inch

H. Gage: 1/12 per inch

I. Face Weight: 24 oz./sq. yd.

J. Primary Backing: Manufacturer's standard material.

K. Secondary Backing: Manufacturer's standard material.

L. Backcoating: Manufacturer's standard material.

M. Backing System: Powerbond Cushion.

N. Roll Width: 72 inch .

O. Applied Treatments:

1. Applied Soil-Resistance Treatment: Manufacturer's standard material.
2. Antimicrobial Treatment: Manufacturer's standard material.

    a. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.

P. Performance Characteristics:
1. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm according to NFPA 253.
2. Dry Breaking Strength: Not less than 100 lbf (445 N) according to ASTM D2646.
3. Delamination: No delamination per ASTM D3936.
4. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.

2.3 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer.

C. Tackless Carpet Stripping: Water-resistant plywood, in strips as required to match cushion thickness and that comply with the Carpet and Rug Institute's CRI 104.

D. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

E. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.
   1. Manufacturer: Schluter, or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance.

B. Examine carpet for type, color, pattern, and potential defects.

C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.

   1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

      a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
      b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

c. Perform additional moisture tests recommended in writing by adhesive and carpet manufacturers. Proceed with installation only after substrates pass testing.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet manufacturer's written installation instructions for preparing substrates.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider, and protrusions more than 1/32 inch (0.8 mm), unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet manufacturers.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 INSTALLATION

A. Comply with the Carpet and Rug Institute's CRI 104 and carpet manufacturer's written installation instructions for the following:

1. Direct-glue-down installation.

B. Comply with carpet manufacturer's written instructions and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.

C. Install pattern parallel to walls and borders.

D. Install borders with mitered corner seams.

E. Do not bridge building expansion joints with carpet.

F. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.

G. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

H. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet as marked on subfloor. Use nonpermanent, nonstaining marking device.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
2. Remove yarns that protrude from carpet surface.
3. Vacuum carpet using commercial machine with face-beater element.

B. Protect installed carpet to comply with the Carpet and Rug Institute's CRI 104.

C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods recommended in writing by carpet manufacturer.

END OF SECTION 096816

SECTION 097723 - FABRIC-WRAPPED PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Vinyl-covered tackboard panels

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include fabric facing, panel edge, core material, and mounting indicated.

B. Shop Drawings: For panel assembly and installation.

1. Include plans, elevations, sections, and mounting devices and details.
2. Include details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge profile and core materials.
3. Include details at cutouts and penetrations for other work.
4. Include direction of fabric weave and pattern matching.

C. Submit samples for verification: 8-inch square units displaying the substrate material and fabric backed vinyl coating and demonstrating quality, weight, color range and pattern variation.

D. Submit manufacturer's written product certification that all furnished core materials and fabric-backed vinyl covering meets or exceeds the specification requirements. Include certified copies of tests specified.

E. Submit manufacturer's written instructions for recommended maintenance of vinyl covered tackboard panel specified. Include acceptable methods and materials recommended to maintain products in anticipated areas of use.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Elevations and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Electrical outlets, switches, controls, and thermostats.
2. Items penetrating or covered by panels including the following:

a. Lighting fixtures.
b. Air outlets and inlets.
c. Speakers.
d. Alarms.
e. Sprinklers.
f. Access panels.

3. Show operation of hinged and sliding components covered by or adjacent to panels.

B. Product Certificates: For each type of panel.

C. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of panel to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal instructions.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials from same production run that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fabric: For each fabric, color, and pattern installed, provide length equal to 10 percent of amount installed, but no fewer than 10 sq. yd. (9 sq. m), full width of bolt.

1.8 QUALITY ASSURANCE

A. Manufacturer: Provide each type of vinyl tack panel from a single source with ability to provide products of consistent quality in appearance and physical properties.

B. Tack panels must be machine laminated (no hand wrapped panels) the machine process insures against the material delaminating from the panel.

C. Installation by skilled and experienced installers with no less than three years of documented experience installing tack panels of this type as specified.

D. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials, fabrication, and installation.

1. Build mockup of typical wall area 48 inches (1200 mm) wide by full height.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Comply with fabric and panel manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver vinyl wallcoverings to the project site in unbroken and undamaged original factory wrappings and clearly labeled with the manufacturer's identification label, quality or grade and lot number.

C. Deliver materials and panels in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not install panels until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Air-Quality Limitations: Protect panels from exposure to airborne odors such as tobacco smoke, and install panels under conditions free from odor contamination of ambient air.

C. Field Measurements: Verify panel locations and actual dimensions of openings and penetrations by field measurements before fabrication, and indicate them on Shop Drawings.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace panels and components that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Fabric sagging, distorting, or releasing from panel edge.
    b. Warping of core.

2. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fabric-wrapped wall panels from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Verify wall materials comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Fire-Test-Response Characteristics: Panels shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

    a. Flame-Spread Index: 25 or less.
    b. Smoke-Developed Index: 450 or less.

2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

2.3 VINYL COVERED TACKBOARD PANELS – **TWP-1**

A. Vinyl Covered Tackboard Panel: Manufacturer's standard panel construction consisting of facing material laminated to front face, edges, and back edge border of core.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Lamvin, Inc.
    b. Chatfield Clarke Co.
    c. ABC School Equipment

d. Claridge Products West

2. Panel Shape: Flat.
3. Mounting: Back mounted with manufacturer's standard adhesive, secured to substrate.

4. Class 1/A Panel Substrate

a. Core: Compressed industrial insulation wood fiberboard
b. Manufacturer: Emco Fire Rated Fiberboard or approved equal
c. Thickness: ½”
d. Density: 16 pcf
e. Weight: .64 pounds per square foot
f. Fire Rating: UL Label

1) Flame Spread: 20
2) Smoke Developed: 30

5. Edge Construction: Manufacturer's standard chemically hardened core with no frame.
6. Edge Profile: Square.
7. Facing Material: As indicated on Drawings.
8. Nominal Core Thickness: 1/2 inch
9. Panel Width: 48” wide
10. Panel Height: Height required to achieve seamless installation

B. Fabric Backed Vinyl Covering

1. Manufacturer: Koroseal Wallcoverings, a Division of RJF International Corporation.
2. Pattern and Color: Selected from Koroseal Wallcovering School Collection or select
3. Width: 54 inches.
4. Fabric Backing: Select

a. Type II: Osnaburg

5. Fire Rating: Class 1 or A

a. Type II: 21 ounces per linear yard

6. Formulation:

a. Mildew inhibitorized
b. Stain resistant coating: Delustered acrylic resin topcoating applied as and integral part of the fabric backed vinyl covering manufacturing process.
c. Early Warning Effect formulation:

2.4 ACCESSORIES

A. Adhesives: Install panels with #317 Adhesive by W.W. Henry or approved equal

B. Moldings: [Select moldings from manufacturer’s standard offering of plastic and metal trim] [Wrap to match the vinyl specified].

2.5 FABRICATION

A. Apply specified primer to selected core material as recommended by core manufacturer.

B. Apply recommended adhesive to exposed face of core.

C. Laminate fabric-backed vinyl covering in numbered sequence from vinyl rolls to insure minimum color variation between tackable panels.

D. Attach vinyl covering to cores to produce installed panels with visible surfaces fully covered and free from bubbles, sags, wrinkles, distortion of vinyl covering, adhesive or foreign material.

E. Wrap panel substrate with fabric-backed vinyl, covering vertical edges and returning vinyl approximately 2 inches on back of panel.

F. Provide sizes wall to ceiling heights and widths as indicated on the drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fabric, fabricated panels, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting panel performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panels in locations indicated. Unless otherwise indicated, install panels with vertical surfaces and edges plumb, top edges level and in alignment with other panels, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Install panels in one piece beginning at center point of the wall and working to room corners.

C. Install adhesive to walls and tack board panels in accordance with adhesive manufacturer's installation instructions, using recommended adhesive and concealed fasteners.

D. Align fabric pattern and grain with adjacent panels.

3.3 INSTALLATION TOLERANCES

A. Variation from Plumb and Level: Plus or minus 1/16 inch (1.6 mm) in 48 inches (1200 mm), noncumulative.

B. Variation of Joint Width: Not more than [**1/16 inch (1.6 mm)**] 1/32 inch (0.79 mm) wide from hairline in 48 inches (1200 mm), noncumulative.

3.4 CLEANING

A. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 097723

SECTION 097726 - INTERIOR SURFACING (ARCHITECTURAL FILM)

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Architectural film interior surfacing for cabinets surfaces.

B. Related Sections:

1. Section 064100 - Architectural Wood Casework (NAAWS Standard) for matching architectural film with casework finish and for hardware.

1.2 REFERENCES

A. ASTM International (ASTM) (www.astm.com) E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. Underwriters Laboratories, Inc. (UL) (www.ul.com):

1. 723 - Test for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. Submittals for Review:

1. Product Data: Manufacturer’s descriptive data for architectural film surfacing and accessories.
2. Samples: 8 x 10 inch architectural film surfacing samples showing specified color and finish.
3. Warranties: Sample warranty form.

B. Shop Drawings:

1. Indicate casework types, sizes and locations to receive architectural film.
2. Include plans, elevations and sections showing locations where architectural film will be applied.
3. Show details of architectural film wrapping corners.

C. Quality Control Submittals:

1. Certificates of Compliance: Certification that architectural film surfacing meets specified fire hazard classification requirements.

D. Closeout Submittals:

1. Maintenance Data: Include maintenance data for installed products, including recommended and harmful cleaning materials and methods.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Installer who has been authorized by manufacturer to install products.

B. Mockup:

1. Size: Minimum of one complete section of casework.
2. Include: Architectural film surfacing and accessories. Include one seam, end panel, drawer, and door.
3. Locate where directed by Architect.
4. Approved mockup may remain as part of the Work.

C. Pre-Installation Conference:

1. Convene at site immediately prior to beginning work of this Section.
2. Attendance: Architect, Contractor, Construction Manager, architectural film surfacing certified installer, and related trades.
3. Review and discuss:

    a. Product delivery and storage, substrate requirements, installation schedule, and protection for completed work.

1.5 DELIVERY, STORAGE AND HANDLING

A. Protect architectural film surfacing from weather, temperature, and harmful conditions as recommended by manufacturer.

B. Store architectural film surfacing in original plastic bags and boxes, at temperature between 38 and 95 degrees F and relative humidity below 80 percent.

C. Do not stack boxes over six units high.

D. Do not use materials beyond one year shelf life.

1.6 PROJECT CONDITIONS

A. Do not install architectural film surfacing at temperatures below 54 degrees F or above 85 degrees F.

1.7 WARRANTIES

A. Furnish architectural film surfacing material manufacturer’s and distributor’s 5 year warranty providing coverage for material and workmanship defects and specifically for: Reduced gloss, developed texture, decomposition, swelling, clouding, tackiness, crazing, bubbling, and cracking of architectural film surfacing.

PART 2 PRODUCTS

2.1 ARCHITECTURAL FILM

A. Architectural overlay with pressure sensitive adhesive backing. Precision manufactured from blend of synthetic, engineered plastics, produced using calendaring process. and printed using high-definition presses.

1. Products: Subject to compliance with requirements, provide the following:
   a. Reatec by Koroseal
   b. Or approved equal

2. Thickness: Maximum 6 mils without adhesive layer, 8.5 mils with adhesive layer.
3. Fire hazard classification: Class A, tested to ASTM E84 and UL 723.
4. Fire door overlays: Meet UL 10B and 10C.
5. Pattern: As selected by Architect.

2.2 ACCESSORIES

A. Medium Density Fiberboard and Raw Wood Sealer:

1. Oil based, low-luster polyurethane type.
2. Acrylic, low-luster polyurethane type; Stays Clear by Benjamin Moore or approved substitute.

PART 3 EXECUTION

3.1 EXAMINATION

A. Ensure that substrates are:
   1. Non-porous and hard.
   2. Free from gaps and overlaps.
   3. Smooth, free from wrinkles and bubbles.

B. Medium Density Fiberboard Substrates; ensure that:
   1. Corners are mitered.
   2. Fasteners are counter sunk 1/8 inch below finished surface.
   3. Joints and seams are flush.

C. Melamine Substrates; ensure that:
   1. Corners are mitered.
   2. Fasteners are counter sunk 1/8 inch below finished surface.
   3. Joints and seams are flush.
   4. Raw edges are edge banded.

3.2 PREPARATION

A. Comply with manufacturer’s instructions for surface preparation.

B. Coordinate substrate requirements with Authorized Installation Partner.

C. Clean substrate; remove substances that could impair overlay bond, including mold, mildew, oil, grease, incompatible primers, and dirt.

D. Finish sand surfaces to achieve proper adhesive bond surface. Re-clean surfaces after any sanding is complete. Apply proper surface sealer, primer, or secondary adhesive as required by substrate complexity. Protect prepared surface from contamination until application.

E. Existing Casework:

1. Wipe surfaces clean; remove dust and loose matter.
2. For existing cork doors, smooth with automotive bondo fill.
3. For existing recessed handles, remove handles, fill and smooth with automotive bondo fill.
4. Apply one thick coat of low luster polyurethane sealer without lines and streaks; allow to dry.
5. Sand surfaces to smooth, consistent surface.
6. Wipe surfaces clean; remove dust and loose matter.
7. Apply second coat of low luster polyurethane without lines and streaks; allow to dry. Sand surfaces to smooth, consistent surface.
8. Wipe surfaces clean; remove dust and loose matter.

F. Existing Melamine Substrates: Wipe surfaces clean; remove dust and loose matter.

G. Prepare other non-porous substrates to smooth, dry, clean surface, free of flaking, unsound coatings, cracks, and defects.

3.3 INSTALLATION

A. Install architectural film surfacing using a Reatec Authorized Installation Partner in accordance with manufacturer's instructions.

B. Install architectural film surfacing without gaps.

C. If using PVC Foam Board to create panels, a reveal of at least ¼" is preferred between panels. Paint or architectural film can be applied directly to the substrate in the reveal area.

D. For three-dimensional components, heat product to mold to substrate so that pattern has continuous, realistic, even appearance.

E. Remove air bubbles, wrinkles, blisters, and other defects.

3.4 CLEANING

A. Consult with Reatec Authorized Installation Partner for specific cleaning requirements based on finish, substrate, and applicable environment.

B. Clean completed surfaces in accordance with manufacturer's instructions.

C. Do not use caustic, acidic, or abrasive cleaners.

3.5 PROTECTION

A. Protect completed surfaces from damage using temporary nonstaining coverings recommended by surfacing manufacturer.

3.6 REPAIR

A. Utilize Reatec Authorized Installation Partner to repair damaged architectural film using materials and procedures approved by architectural film manufacturer.

END OF SECTION

SECTION 097726 - INTERIOR SURFACING (ARCHITECTURAL FILM)

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Architectural film interior surfacing for cabinets surfaces.

B. Related Sections:

1. Section 064100 - Architectural Wood Casework (NAAWS Standard) for matching architectural film with casework finish and for hardware.

1.2 REFERENCES

A. ASTM International (ASTM) (www.astm.com) E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. Underwriters Laboratories, Inc. (UL) (www.ul.com):

1. 723 - Test for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. Submittals for Review:

1. Product Data: Manufacturer’s descriptive data for architectural film surfacing and accessories.
2. Samples: 8 x 10 inch architectural film surfacing samples showing specified color and finish.
3. Warranties: Sample warranty form.

B. Shop Drawings:

1. Indicate casework types, sizes and locations to receive architectural film.
2. Include plans, elevations and sections showing locations where architectural film will be applied.
3. Show details of architectural film wrapping corners.

C. Quality Control Submittals:

1. Certificates of Compliance: Certification that architectural film surfacing meets specified fire hazard classification requirements.

D. Closeout Submittals:

1. Maintenance Data: Include maintenance data for installed products, including recommended and harmful cleaning materials and methods.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Installer who has been authorized by manufacturer to install products.

B. Mockup:

1. Size: Minimum of one complete section of casework.
2. Include: Architectural film surfacing and accessories. Include one seam, end panel, drawer, and door.
3. Locate where directed by Architect.
4. Approved mockup may remain as part of the Work.

C. Pre-Installation Conference:

1. Convene at site immediately prior to beginning work of this Section.
2. Attendance: Architect, Contractor, Construction Manager, architectural film surfacing certified installer, and related trades.
3. Review and discuss:

a. Product delivery and storage, substrate requirements, installation schedule, and protection for completed work.

1.5 DELIVERY, STORAGE AND HANDLING

A. Protect architectural film surfacing from weather, temperature, and harmful conditions as recommended by manufacturer.

B. Store architectural film surfacing in original plastic bags and boxes, at temperature between 38 and 95 degrees F and relative humidity below 80 percent.

C. Do not stack boxes over six units high.

D. Do not use materials beyond one year shelf life.

1.6 PROJECT CONDITIONS

A. Do not install architectural film surfacing at temperatures below 54 degrees F or above 85 degrees F.

1.7 WARRANTIES

A. Furnish architectural film surfacing material manufacturer’s and distributor’s 5 year warranty providing coverage for material and workmanship defects and specifically for: Reduced gloss, developed texture, decomposition, swelling, clouding, tackiness, crazing, bubbling, and cracking of architectural film surfacing.

PART 2 PRODUCTS

2.1 ARCHITECTURAL FILM

A. Architectural overlay with pressure sensitive adhesive backing. Precision manufactured from blend of synthetic, engineered plastics, produced using calendaring process. and printed using high-definition presses.

1. Products: Subject to compliance with requirements, provide the following:
   a. Reatec by Koroseal
   b. Or approved equal

2. Thickness: Maximum 6 mils without adhesive layer, 8.5 mils with adhesive layer.
3. Fire hazard classification: Class A, tested to ASTM E84 and UL 723.
4. Fire door overlays: Meet UL 10B and 10C.
5. Pattern: As selected by Architect.

2.2 ACCESSORIES

A. Medium Density Fiberboard and Raw Wood Sealer:

1. Oil based, low-luster polyurethane type.
2. Acrylic, low-luster polyurethane type; Stays Clear by Benjamin Moore or approved substitute.

PART 3 EXECUTION

3.1 EXAMINATION

A. Ensure that substrates are:
   1. Non-porous and hard.
   2. Free from gaps and overlaps.
   3. Smooth, free from wrinkles and bubbles.

B. Medium Density Fiberboard Substrates; ensure that:
   1. Corners are mitered.
   2. Fasteners are counter sunk 1/8 inch below finished surface.
   3. Joints and seams are flush.

C. Melamine Substrates; ensure that:
   1. Corners are mitered.
   2. Fasteners are counter sunk 1/8 inch below finished surface.
   3. Joints and seams are flush.
   4. Raw edges are edge banded.

3.2 PREPARATION

A. Comply with manufacturer’s instructions for surface preparation.

B. Coordinate substrate requirements with Authorized Installation Partner.

C. Clean substrate; remove substances that could impair overlay bond, including mold, mildew, oil, grease, incompatible primers, and dirt.

D. Finish sand surfaces to achieve proper adhesive bond surface. Re-clean surfaces after any sanding is complete. Apply proper surface sealer, primer, or secondary adhesive as required by substrate complexity. Protect prepared surface from contamination until application.

E. Existing Casework:

1. Wipe surfaces clean; remove dust and loose matter.
2. For existing cork doors, smooth with automotive bondo fill.
3. For existing recessed handles, remove handles, fill and smooth with automotive bondo fill.
4. Apply one thick coat of low luster polyurethane sealer without lines and streaks; allow to dry.
5. Sand surfaces to smooth, consistent surface.
6. Wipe surfaces clean; remove dust and loose matter.
7. Apply second coat of low luster polyurethane without lines and streaks; allow to dry. Sand surfaces to smooth, consistent surface.
8. Wipe surfaces clean; remove dust and loose matter.

F. Existing Melamine Substrates: Wipe surfaces clean; remove dust and loose matter.

G. Prepare other non-porous substrates to smooth, dry, clean surface, free of flaking, unsound coatings, cracks, and defects.

3.3 INSTALLATION

A. Install architectural film surfacing using a Reatec Authorized Installation Partner in accordance with manufacturer’s instructions.

B. Install architectural film surfacing without gaps.

C. If using PVC Foam Board to create panels, a reveal of at least ¼” is preferred between panels. Paint or architectural film can be applied directly to the substrate in the reveal area.

D. For three-dimensional components, heat product to mold to substrate so that pattern has continuous, realistic, even appearance.

E. Remove air bubbles, wrinkles, blisters, and other defects.

3.4 CLEANING

A. Consult with Reatec Authorized Installation Partner for specific cleaning requirements based on finish, substrate, and applicable environment.

B. Clean completed surfaces in accordance with manufacturer’s instructions.

C. Do not use caustic, acidic, or abrasive cleaners.

3.5 PROTECTION

A. Protect completed surfaces from damage using temporary nonstaining coverings recommended by surfacing manufacturer.

3.6 REPAIR

A. Utilize Reatec Authorized Installation Partner to repair damaged architectural film using materials and procedures approved by architectural film manufacturer.

END OF SECTION

SECTION 099114 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Surface preparation and application of paint systems on exterior substrates.

a. Concrete.
b. Fiber-cement board.
c. Clay masonry.
d. Concrete masonry units (CMUs).
e. Steel and iron.
f. Galvanized metal.
g. Aluminum (not anodized or otherwise coated).
h. Stainless steel.
i. Wood.
j. Fiberglass.
k. Plastic.
l. Portland cement plaster (stucco).
m. Gypsum board.

B. Related Requirements:
1. Section 055213 "Pipe and Tube Railings"

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include preparation requirements and application instructions.
2. Indicate VOC content.

B. Manufacturer’s Label: Provide a color copy of the manufacturer’s label for each product being used. This label shall include the product name, number, and sheen. Product labels shall match material brought on site and will be inspected by inspector. Onsite materials not matching submittals, or not labeled, shall be removed from the site and replaced with properly labeled materials at no cost to the owner.

C. Samples: For each type of topcoat product.

D. Samples for Initial Selection: For each type of topcoat product.

E. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit three (3) Samples on rigid backing, 8 inches (200 mm) square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

F. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in the Exterior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.5 MOCKUP

A. Apply mockups of each paint system indicated and each color and finish selected to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, color designation, and instructions for mixing and reducing.

1.7 COORDINATION

A. Review other sections in which prime paints are to be provided to ensure compatibility of total coating system for various substrates. Upon request from other trades, furnish information or characteristics of finish materials provided for use, to ensure compatible prime coats are used.

1.8 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Sherwin-Williams Company (The).

B. Source Limitations: Obtain paint from single source from single manufacturer.

2.2 PAINT GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. VOC Content: For field applications, verify paints and coatings comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Flat Paints and Coatings: 50 g/L.

2. Nonflat Paints and Coatings: 50 g/L.
3. Dry-Fog Coatings: 150 g/L.
4. Primers, Sealers, and Undercoaters: 100 g/L.
5. Rust-Preventive Coatings: 100 g/L.
6. Zinc-Rich Industrial Maintenance Primers: 100 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Shellacs, Clear: 730 g/L.
9. Shellacs, Pigmented: 550 g/L.

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Fiber-Cement Board: 12 percent.
3. Masonry (Clay and CMUs): 12 percent.
4. Wood: 15 percent.
5. Portland Cement Plaster: 12 percent.
6. Gypsum Board: 12 percent.

C. Portland Cement Plaster Substrates: Verify that plaster is fully cured.

D. Exterior Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

E. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

F. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
1. SSPC-SP 3.

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal with Krud Kutter Metal Clean and Etch to dissolve passivator and use mechanical methods as necessary,to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Aluminum Substrates: Remove loose surface oxidation.

J. Wood Substrates:

1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
2. Sand surfaces that will be exposed to view, and remove sanding dust.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

K. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 INSTALLATION

A. Apply paints in accordance with manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
3. Paint all 6 (six) sides of exterior doors - both sides and all edges - and entire exposed surface of exterior door frames.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in the Exterior Painting Schedule may be omitted on items that are factory primed or factory finished if compatible with intermediate and topcoat coatings and acceptable to intermediate and topcoat paint manufacturers.

6. For previously painted or factory primed surfaces where bare substrate is exposed, spot prime with manufacturer recommended primer.
7. Previously painted surfaces may require full prime and is subject to field inspection recommendation.
8. Dark Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

1. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

F. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed to view:

a. Equipment, including panelboards.
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written instructions, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written instructions.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
3. Allow empty paint cans to dry before disposal.
4. Collect waste paint by type and deliver to recycling or collection facility.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces:

1. Latex System:

a. Prime Coat: Primer, alkali resistant, water based.
   1) S-W Loxon Concrete & Masonry Primer/Sealer (LX02W0050).
   2) Or approved equal

b. Prime Coat, Latex: Exterior, matching topcoat.
c. Intermediate Coat: Latex, exterior, matching topcoat.

d. Low-Sheen Topcoat: Latex, exterior, low sheen
   1) S-W Solo Exterior Latex Flat, (A75 Series)
   2) Or approved equal

B. Cement Board Substrates:

1. Latex System:

   a. Latex Prime Coat: Exterior, matching topcoat.
   b. Alkali-Resistant Prime Coat: Primer, alkali resistant, water based.
      1) S-W Loxon Concrete & Masonry Primer/Sealer (LX02W0050).
      2) Or approved equal

   c. Intermediate Coat: Latex, exterior, matching topcoat.
   d. Low-Sheen Topcoat: Latex, exterior, low sheen
      1) S-W Solo Exterior Latex Satin, (A75 Series).
      2) Or approved equal

C. CMU Substrates:

1. Latex System:

   a. Prime Coat: Block filler, latex, interior/exterior.
      1) S-W Conflex™ Block Filler (CF01W0050).
      2) Or approved equal

   b. Intermediate Coat: Latex, exterior, matching topcoat.
   c. Low-Sheen Topcoat: Latex, exterior, low sheen
      1) S-W Solo Exterior Latex Satin, (A75 Series).
      2) Or approved equal

2. Latex over Alkali-Resistant Primer System:

   a. Prime Coat: Primer, alkali resistant, water based.
      1) S-W Loxon Concrete & Masonry Primer/Sealer (LX02W0050).
      2) Or approved equal

   b. Intermediate Coat: Latex, exterior, matching topcoat.
   c. Low-Sheen Topcoat: Latex, exterior, low sheen
      1) S-W Solo Exterior Latex Satin, (A75 Series).
      2) Or approved equal

D. Steel and Iron Substrates:

1. Alkyd System:

   a. Alkyd Prime Coat: Primer, alkyd, anticorrosive, for metal.

      1) BLOC-RUST Rust Preventive Primer (BRPR00).
      2) S-W Steel SPEC® 3002 Universal Primer (B50AS200).

3) Rust-Oleum CV740 Alkyd Metal Primer Low VOC
4) Or approved equal

b. Shop Prime Coat: Shop primer specified in Section where substrate is specified.
c. Surface-Tolerant Prime Coat: Primer, metal, surface tolerant.

1) ENDURAPRIME Acrylic Metal Primer (ENPR00)
2) S-W Pro Industrial™ Pro-Cryl© Universal Acrylic Metal Primer (B66-1300 Series).
3) Rust-Oleum CV740 Alkyd Metal Primer Low VOC
4) Or approved equal

d. Intermediate Coat: Exterior, alkyd enamel, matching topcoat.
e. Semigloss Topcoat: Alkyd, exterior, semigloss
1) S-W Pro Industrial™ Waterbased Alkyd Urethane Enamel Semi-gloss (B53-1150 Series).
2) Or approved equal

2. Quick-Dry Enamel System:

a. Prime Coat: Primer, alkyd, quick dry, for metal.

1) Rustoleum Universal Alkyd Primer
2) S-W Steel SPEC® 3002 Universal Primer (B50AS200)
3) Zinsser High Hide Cover Stain Oil Based Primer
4) Or approved equal

b. Intermediate Coat: Alkyd, quick dry, matching topcoat.
c. Semigloss Topcoat: Alkyd, quick dry, semigloss

1) Rustoleum 7400 System DTM Alkyd Enamel
2) S-W Pro Industrial™ Waterbased Alkyd Urethane Enamel Semi-gloss (B53-1150 Series).
3) Or approved equal

E. Galvanized-Metal Substrates:

1. Latex System:

a. Water-Based Prime Coat: Primer, galvanized, water based.
1) S-W Pro Industrial™ Pro-Cryl© Universal Acrylic Metal Primer (B66-1300 Series).
2) Or approved equal

b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Semigloss Topcoat: Latex, exterior, semigloss
1) S-W Solo 100% Acrylic Int/Ext, Semi-gloss (A76 Series)
2) Or approved equal

2. Water-Based Light Industrial Coating System:

a. For use at handrails unless otherwise noted
b. Acrylic Prime Coat: Primer, galvanized, water based.
   1) S-W Pro Industrial™ Pro-Cryl© Universal Acrylic Metal Primer (B66-1300 Series).
   2) Or approved equal

c. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
d. Semigloss Topcoat: Light industrial coating, exterior, water based, semigloss
   1) S-W Pro Industrial DTM, Semi-gloss (B66-1150 Series)
   2) Or approved equal

e. Intermediate Coat: Exterior, alkyd enamel, matching topcoat.
f. Semigloss Topcoat: Alkyd, exterior, semigloss
   1) S-W Pro Industrial™ Waterbased Alkyd Urethane Enamel Semi-gloss (B53-1150 Series
   2) Or approved

F. Aluminum Substrates:

1. Latex System:

   a. Prime Coat: Primer, quick dry, for aluminum.

      1) ULTRASHIELD® Galvanized Metal Primer (ULGM00)
      2) S-W Extreme Bond™ Interior Exterior Primer (B51W00150)
      3) Or approved equal

   b. Intermediate Coat: Latex, exterior, matching topcoat.
   c. Semigloss Topcoat: Latex, exterior, semigloss
      1) S-W Solo 100% Acrylic Int/Ext, Semi-gloss (A76 Series)
      2) Or approved

2. Alkyd System:

   a. Pretreatment Prime Coat: Vinyl wash primer.

      1) Krud Kutter Metal Clean & Etch

   b. Prime Coat: Primer, quick dry, for aluminum.
      1) S-W Extreme Bond™ Interior Exterior Primer (B51W00150).
      2) Or approved equal

   c. Intermediate Coat: Exterior, alkyd enamel, matching topcoat.
   d. Semigloss Topcoat: Alkyd, exterior, semigloss
      1) S-W Pro Industrial™ Waterbased Alkyd Urethane Enamel Semi-gloss (B53-1150 Series).
      2) Or approved equal

G. Wood Substrates: Exposed framing.

1. Latex over Latex Primer System:

a. Prime Coat: Primer, latex for exterior wood.
1) S-W Exterior Latex Wood Primer (B42W08141).
2) Or approved equal

b. Semigloss Topcoat: Latex, exterior, semigloss
1) S-W Solo 100% Acrylic Int/Ext, Semi-gloss (A76 Series).
2) Or approved equal

H. Wood Substrates: Wood trim, Architectural woodwork, Doors, Windows, Wood board siding.

1. Latex over Latex Primer System:

a. Prime Coat: Primer, latex for exterior wood.
1) S-W Exterior Latex Wood Primer (B42W08141).
2) Or approved equal

b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Semigloss Topcoat: Latex, exterior, semigloss
1) S-W Solo 100% Acrylic Int/Ext, Semi-gloss (A76 Series).
2) Or approved equal

I. Wood Substrates: Wood-based panel products.

1. Latex over Latex Primer System:

a. Prime Coat: Primer, latex for exterior wood.
1) S-W Exterior Latex Wood Primer (B42W08141).
2) Or approved equal

b. Semigloss Topcoat: Latex, exterior, semigloss
1) S-W Solo 100% Acrylic Int/Ext, Semi-gloss (A76 Series).
2) Or approved equal

J. Fiberglass Substrates:

1. Latex System:

a. Prime Coat: Primer, bonding, solvent based.
1) S-W Extreme Bond™ Interior Exterior Primer (B51W00150).
2) Or approved equal

b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Semigloss Topcoat: Latex, exterior, semigloss
1) S-W Solo 100% Acrylic Int/Ext, Semi-gloss (A76 Series).
2) Or approved equal

K. Plastic Trim Fabrication Substrates:

1. Latex System:

a. Water-Based Prime Coat: Primer, bonding, water based.
1) S-W Extreme Bond™ Interior Exterior Primer (B51W00150).
2) Or approved equal

b. Solvent-Based Prime Coat: Primer, bonding, solvent based.
1) S-W Extreme Bond™ Interior Exterior Primer (B51W00150).
2) Or approved equal

c. Intermediate Coat: Latex, exterior, matching topcoat.
d. Semigloss Topcoat: Latex, exterior, semigloss
1) S-W Solo 100% Acrylic Int/Ext, Semi-gloss (A76 Series).
2) Or approved equal

2. Alkyd System:

a. Water-Based Prime Coat: Primer, bonding, water based.
1) S-W Extreme Bond™ Interior Exterior Primer (B51W00150).
2) Or approved equal

b. Solvent-Based Prime Coat: Primer, bonding, solvent based.
1) S-W Extreme Bond™ Interior Exterior Primer (B51W00150).
2) Or approved equal

c. Intermediate Coat: Exterior, alkyd enamel, matching topcoat.
d. Semigloss Topcoat: Alkyd, exterior, semigloss
1) S-W Pro Industrial™ Waterbased Alkyd Urethane Enamel Semi-gloss (B53-1150 Series).
2) Or approved equal

L. Portland Cement Plaster Substrates:

1. Latex System:

a. Latex Prime Coat: Latex, exterior, matching topcoat.
b. Alkali-Resistant Prime Coat: Primer, alkali resistant, water based.
1) S-W Loxon Concrete & Masonry Primer/Sealer (LX02W0050).
2) Or approved equal

c. Intermediate Coat: Latex, exterior, matching topcoat.
d. Low-Sheen Topcoat: Latex, exterior, low sheen
1) S-W Solo Exterior Latex Satin, (A75 Series).
2) Or approved equal

END OF SECTION 099114

SECTION 099124 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes surface preparation and the application of paint systems on interior substrates.

1. Concrete.
2. Concrete masonry units (CMUs).
3. Steel and iron.
4. Galvanized metal.
5. Aluminum (not anodized or otherwise coated).
6. Stainless steel.
7. Wood.
8. Gypsum board.
9. Acoustic panels and tiles.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Indicate VOC content.

B. Manufacturer’s Label: Provide a color copy of the manufacturer’s label for each product being used. This label shall include the product name, number, and sheen. Product labels shall match material brought on site and will be inspected by inspector. Onsite materials not matching submittals, or not labeled, shall be removed from the site and replaced with properly labeled materials at no cost to the owner.

C. Samples for Initial Selection: For each type of topcoat product.

D. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit three (3) Samples on rigid backing, 8 inches (200 mm) square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

E. Product List: Use same designations indicated on Drawings and in the Interior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.5 MOCKUP

A. Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

B. Container Label: Include manufacturer’s name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, color designation, and instructions for mixing and reducing.

1.7 COORDINATION

A. Review other sections in which prime paints are to be provided to ensure compatibility of total coating system for various substrates. Upon request from other trades, furnish information or characteristics of finish materials provided for use, to ensure compatible prime coats are used.

1.8 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Sherwin-Williams Company (The).

B. Source Limitations: Obtain paint from single source from single manufacturer.

2.2 PAINT, GENERAL

A. Material Compatibility:

   1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. Low-Emitting Materials: For field applications that are inside the weatherproofing system, verify 90 percent of paints and coatings comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and CMUs): 12 percent.
3. Wood: 15 percent.
4. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
1. SSPC-SP 3.

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal with Krud Kutter Metal Clean and Etch to dissolve passivator and use mechanical methods as necessary,to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints..

I. Aluminum Substrates: Remove loose surface oxidation.

J. Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 INSTALLATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
6. For previously painted or factory primed surfaces where bare substrate is exposed, spot prime with manufacturer recommended primer.
7. Previously painted surfaces may require full prime and is subject to field inspection and recommendations.
8. Dark Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

1. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

F. Painting Fire-Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:

a. Equipment, including panelboards.
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.
g. Tanks that do not have factory-applied final finishes.
h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.

2. Paint the following work where exposed in occupied spaces:

a. Equipment, including panelboards.
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.
g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
h. Other items as directed by Architect.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

A. Dry-Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry-film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry-film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry-film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
3. Allow empty paint cans to dry before disposal.
4. Collect waste paint by type and deliver to recycling or collection facility.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces:

1. Latex System:

a. Prime Coat: Primer, alkali resistant, water based.
   1) S-W Loxon Concrete & Masonry Primer/Sealer (LX02W0050)
   2) Or approved equal

b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior

1) S-W ProMar 200 Zero VOC Latex Eg-Shel (B20-12600 Series)
2) Or approved equal

d. Topcoat: Latex, interior, semigloss
1) Or approved equal

B. CMU Substrates:

1. Water-Based Light-Industrial Coating System: For use in high-traffic areas where cleanability and durability are of extra concern, including trash areas and loading dock areas.

a. Block Filler: Latex, interior/exterior.
1) S-W Conflex™ Block Filler (CF01W0050).
2) Or approved equal

b. Intermediate Coat: Light-industrial coating, interior, water based, matching topcoat.
c. Topcoat: Light-industrial coating, interior, water based
1) S-W Pro Industrial DTM Acrylic Egg-shell (B66-1250 Series).
2) Or approved equal

d. Topcoat: Light-industrial coating, interior, water based, semigloss
1) S-W Pro Industrial™ DTM Acrylic Semi-gloss (B66-1150 Series).
2) Or approved equal

C. Steel Substrates:

1. Water-Based Alkyd System:

a. Prime Coat: Primer, quick dry, for metal.
1) S-W Pro Industrial™ Pro-Cryl© Universal Acrylic Metal Primer (B66-1300 Series).
2) Or approved equal

b. Prime Coat: Primer, alkyd, anticorrosive, for metal.
1) S-W Steel SPEC® 3002 Universal Primer (B50AS200).
2) Zinsser High Hide Cover Stain Primer
3) Or approved equal

c. Intermediate Coat: Alkyd Water-Based, interior, matching topcoat.
d. Topcoat: Water-Based Alkyd, interior, semigloss
1) S-W Pro Industrial™ Waterbased Alkyd Urethane Enamel Semi-gloss (B53-1150 Series.
2) Or approved equal

D. Galvanized-Metal Substrates:

1. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Primer, galvanized, water based.
   1) S-W Pro Industrial™ Pro-Cryl© Universal Acrylic Metal Primer (B66-1300 Series).
   2) Or approved equal

b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC, semigloss
   1) S-W ProMar 200 Zero VOC Semi-gloss (B31-2600 Series).
   2) Or approved equal

E. Aluminum (Not Anodized or Otherwise Coated) Substrates:

1. Alkyd System:

a. Prime Coat: Primer, quick dry, for aluminum.
   1) S-W Pro Industrial™ Pro-Cryl© Universal Acrylic Metal Primer (B66-1300 Series).
   2) Or approved equal

b. Intermediate Coat: Alkyd Water-Based, interior, matching topcoat.
c. Topcoat: Water-Based Alkyd Water-Based, interior, semigloss
   1) S-W Pro Industrial™ Waterbased Alkyd Urethane Enamel Semi-gloss (B53-1150 Series).
   2) Or approved equal

F. Wood Substrates: Architectural woodwork, wood doors.

1. Latex over Latex Primer System:

a. Prime Coat: Primer, latex, for interior wood.
   1) S-W Premium Wall & Wood Interior Latex Primer (B28W08111).
   2) Or approved equal

b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior, semigloss
   1) S-W ProMar 200 Zero VOC Semi-gloss (B31-2600 Series).
   2) Or approved equal

G. Gypsum Board and Plaster Substrates:

1. Latex over Latex Sealer System:

a. Prime Coat: Primer sealer, latex, interior.
   1) S-W ProMar 200 Zero VOC Primer (B28W02600).
   2) Or approved equal

b. Prime Coat: Latex, interior, matching topcoat.
c. Intermediate Coat: Latex, interior, matching topcoat.
d. Topcoat: Latex, interior, flat. At all ceilings and soffits, unless otherwise noted.

1) ProMar 200 Ceiling Paint Flat (A27W05050).
2) Or approved equal

e. Topcoat: Latex, interior. At all walls, unless otherwise noted.
1) S-W ProMar 200 Zero VOC Latex Eg-Shel (B20-12600 Series).
2) Or approved equal

f. Topcoat: Latex, interior, semigloss. At all restroom and foodservice walls and ceilings, unless otherwise noted.

1) S-W ProMar 200 Zero VOC Semi-gloss (B31W2600).
2) Or approved equal

H. Acoustic Panels and Tiles:

1. Latex, Flat System:

a. Prime Coat: Latex, interior, matching topcoat.
b. Topcoat: Latex, interior, flat
1) ProCoat™ ProCoustic Accoustical Tile And Ceiling Coating
2) Or approved equal

I. Foil-Wrapped pipe and duct coverings.

1. Latex System:

a. Intermediate Coat: Latex, interior, matching topcoat.
b. Topcoat: Latex, interior, flat
1) S-W Pro Industrial Waterborne Acrylic Dryfall Flat (B42W00181).
2) Or approved equal

c. Topcoat: Latex, interior
1) S-W Pro Industrial Waterborne Acrylic Dryfall Eg-shel (B42W0018).
2) Or approved equal

d. Topcoat: Latex, interior, semigloss
1) S-W Pro Industrial Waterborne Acrylic Dryfall Semi-gloss (B42W00083).
2) Or approved equal

END OF SECTION 099124

SECTION 101100 - VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Markerboards.

B. Related Requirements:

   1. Section 097723 "Fabric-Wrapped Panels" for tackable, fabric-covered panels mounted on walls.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.

B. Shop Drawings: For visual display units.

   1. Include plans, elevations, sections, details, and attachment to other work.
   2. Show locations and layout of special-purpose graphics.
   3. Include sections of typical trim members.

C. Samples: For each type of visual display unit indicated.

   1. Visual Display Panel: Not less than 8-1/2 by 11 inches (215 by 280 mm), with facing, core, and backing indicated for final Work. Include one panel for each type, color, and texture required.
   2. Trim: 6-inch- (150-mm-) long sections of each trim profile.
   3. Display Rail: 6-inch- (150-mm-) long section of each type.
   4. Support System: 6-inch- (150-mm-) long sections.
   5. Accessories: Full-size Sample of each type of accessory.

D. Product Schedule: For visual display units. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each visual display unit, for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For visual display units and motorized units to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.10 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Surfaces lose original writing and erasing qualities.
b. Surfaces exhibit crazing, cracking, or flaking.

2. Warranty Period: 50 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.

2.2 MARKERBOARD PANELS

A. Porcelain-Enamel Markerboard Panels: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction, consisting of moisture-barrier backing, core material, and porcelain-enamel face sheet with low-gloss finish. Laminate panels under heat and pressure with manufacturer's standard, flexible waterproof adhesive.

1. Products: Subject to compliance with requirements, provide products by one of the following:

    a. Claridge Products & Equipment, Inc.
    b. Best-Rite
    c. Carolina
    d. Ghent
    e. Greensteel
    f. Lemco
    g. Marsh
    h. Nelson
    i. Or approved equal

2. Surface: Magnetic, porcelain on steel surface.
3. Particleboard Core: 3/8 inch thick; with 0.015-inch- (0.38-mm-) thick, aluminum sheet backing.
4. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.
5. Size : As shown on Drawings
6. Chalktray: Manufacturer's standard; continuous.

    a. Box Type: Extruded aluminum with slanted front, grooved tray, and cast-aluminum end closures.
    b. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.

7. Display Rail: Manufacturer's standard, extruded-aluminum display rail with plastic-impregnated-cork insert, end stops, and continuous paper holder, designed to hold accessories.

a. Size: 1 inch (25 mm) high by full length of visual display unit.
b. Map Hooks: Two map hooks for every 48 (1200) inches (mm) of display rail or fraction thereof.
c. Map Hooks and Clips: Two map hooks with flexible metal clips for every 48 (1200) inches (mm) of display rail or fraction thereof.
d. Flag Holder: One for each room.

2.3 MATERIALS

A. Porcelain-Enamel Face Sheet: PEI-1002, with face sheet manufacturer's standard two- or three-coat process.

B. Particleboard: ANSI A208.1, Grade M-1.

C. MDF: ANSI A208.2, Grade 130.

D. Extruded Aluminum: ASTM B221 (ASTM B221M), Alloy 6063.

E. Adhesives for Field Application: Mildew-resistant, nonstaining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application; as recommended in writing by visual display unit manufacturer.

F. Primer/Sealer: Mildew-resistant primer/sealer complying with requirements in Section 099124 "Interior Painting" and recommended in writing by visual display unit manufacturer for intended substrate.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

B. Examine walls and partitions for proper preparation and backing for visual display units.

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

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.

C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.

D. Prime wall surfaces indicated to receive visual display units and as recommended in writing by primer/sealer manufacturer and visual display unit manufacturer.

3.3 INSTALLATION

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

B. Factory-Fabricated Visual Display Board Assemblies: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than 16 inches (400 mm) o.c. Secure tops and bottoms of boards to walls.

C. Visual Display Board Assembly Mounting Heights: Install visual display units at mounting heights indicated on Drawings, or if not indicated, at heights indicated below.
   1. Mounting Height for Grades 4 through 6: 30 inches (mm) above finished floor to top of chalktray.
   2. Mounting Height for Grades 7 and Higher: 36 (914) inches (mm) above finished floor to top of chalktray.

D. Display Rails: Install rails at mounting heights indicated on Drawings, or if not indicated, at height indicated below. Attach to wall surface with fasteners at not more than 16 inches (400 mm) o.c.

1. Join adjacent panels with concealed steel splines for smooth alignment.

3.4 CLEANING AND PROTECTION

A. Clean visual display units in accordance with manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display units after installation and cleaning.

END OF SECTION 101100

SECTION 101400 - SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Exterior parking signage.
2. Room and door identification signage.
3. Toilet room signage.
4. Miscellaneous signage.

1.3 UNIT PRICES

A. The bid quantity for each Sign Type shall be based on the Sign Schedule shown in the Drawings. The Contract shall establish unit costs based on these quantities, and the bid shall consist of extensions of these unit costs. The contract shall be adjusted as necessary, using these unit costs, for additions or deletions within ten percent of the base bid quantity for each Sign Type.

1.4 SUBMITTALS

A. Allowance for Submittals: Allow for thorough and complete preparation of all submittal items, for delivery and/or shipping of same, and for resubmittal(s) as required until approval has been obtained for all items.

B. Product Data: Submit manufacturers' catalog sheets, brochures, diagrams, schedules, charts, illustrations, test results and/or other standard descriptive data.

1. Mark up each copy to identify pertinent materials, products or models.
2. Show dimensions and clearances required, performance characteristics and capacities, and wiring diagrams and/or controls as apply.

C. Submit manufacturer's installation instructions for each type of specialty sign. Include only pages which are pertinent, or manufacturer's standard drawings modified to delete non-applicable data.

D. Shop Drawings:

1. General:

    a. All shop drawings shall be neat, well organized, and clearly legible.
    b. All shop drawings shall be drawn to scale and not subsequently reduced to fit a drawing format.

2. For room and door identification signs.

    a. Include fabrication and installation details and attachments to other work.
    b. Show sign mounting heights and locations.
    c. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

E. Schedule:

1. For signage prepared by or under the supervision of a supplier use same reference numbers for details and types as those on the Drawings.
2. Text shown in the Drawing details is for layout purposes only; all final text, quantities and references for all signs are shown in the Sign Schedule unless otherwise noted.
3. Final text, numbers and graphics shall be approved by Architect and Owner prior to fabrication.

    a. The Contractor shall clarify any perceived irregularities in the Sign Schedule with the Architect prior to fabrication.

F. Samples

1. Color and Finish: Submit 3 each, 6 inch x 6 inch samples of all paint colors, screen colors, vinyl colors and material finishes. All paint and screen colors are to be applied to the appropriate substrate.

    a. Contractor to submit verification of paint manufacturer used for submittal.
    b. Prior to submittal, Contractor shall verify that all colors submitted as samples match accurately the samples or specifications provided by Architect.

2. Dimensional Characters: Full-size Sample of dimensional character.
3. Exposed Accessories: Full-size Sample of each accessory type.
4. Typeface(s): Submit complete typeface font(s), including upper and lower case letters, numbers and punctuation, for all typeface(s) specified. Also submit samples of letter and word spacing for each cap height specified.
5. Full-size complete prototype of the following sign types:

    a. Exterior grade tactile sign using typical door sign.
    b. Interior grade tactile sign using typical door sign.
    c. Interior grade toilet room sign showing restroom door symbol including frame condition.

6. Samples and prototype shall not be permanently installed, but shall be retained by the Architect for record and quality control, unless otherwise noted by the Architect.

1.5 QUALITY ASSURANCE

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

B. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA); CAC, Title 24, 2022 CBC Chapters 10 & 11B and with code provisions as adopted by authorities having jurisdiction. Code-governed signs shall be field inspected per CBC 11B-703.1.1.2.

C. Do not scale drawings for dimensions. Use only the written dimensions indicated on the Drawings, unless such be found in error. Contractor shall verify and be responsible for all dimensions and conditions shown by the Drawings and shall visit the site to inspect and verify field conditions prior to fabrication and installation. The Architect shall be notified, in writing, of all discrepancies on Drawings, in field dimensions or conditions, and of changes required in construction details.

1.6 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 room temperature.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Provide each type of sign as a complete unit produced by a single manufacturer, including all required mounting accessories, fittings and fastenings.

2.2 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and Americans with Disabilities Act (ADA); CAC, Title 24, 2022 CBC Chapters 10 & 11B.

1. Provide non-glare finish with characters contrasting with background per 11B-703.5.1.

B. Interior Code Signage: Provide signage as required by accessibility regulations and requirements of authorities having jurisdiction. These include, but are not limited to, the following:

1. All signs identifying permanent rooms and spaces shall be located in compliance with CBC 11B-703.4:

a. Top of sign to be 5’0” above finish floor.
b. Sign to be located at latch side of door, or, if there is insufficient wall space, on the nearest wall, preferably to the right.

2. Symbol signs on restroom doors shall be located in compliance with CBC 11B-703.4:

a. Centerline of sign to be 5’0” above finish floor.
b. Sign to be centered left to right on door.

3. Room Capacity.

C. Thermal Movements: For exterior fabricated dimensional characters, allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (49 deg C), ambient; 180 deg F (82 deg C), material surfaces.

2.3 EXTERIOR PARKING SIGNAGE

A. Accessible Parking Signs:

1. Material: 0.080-inch aluminum or other noncorrosive material.
2. Size: Minimum of 70 square inches in area.
3. Background Color: Blue.
4. Text Material: White silk-screen, with reflective white border.
5. Spaces complying with CBC 11B-502.6 shall have an additional sign stating “Van Accessible” mounted below the symbol of accessibility.
6. Signs to be reflectorized.

B. Unauthorized Vehicles:

1. Material: 0.080-inch aluminum or other noncorrosive material.
2. Size: 18 inches by 24 inches.
3. Background: White.
4. Text Material: Black.
5. Text: As shown on the Drawings.
6. Signs to be reflectorized.

C. Mounting: Pole mounted as shown in drawings.

2.4 ROOM AND DOOR IDENTIFICATION SIGNAGE

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Arne Signs
   b. Or approved Equal

B. Signs with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles.

1. Material: Modified acrylic substrate
2. Copy: Tactile and braille

3. Character Style: As indicated on Drawings
4. Text: As indicated on Drawings.
5. Colors: High contrast, selected by Architect from manufacturer's full range.

2.5 TOILET ROOM SIGNAGE

A. Signs with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles.

1. Material: Cast-acrylic sheet, 1/4 inch thick.
2. Copy: Tactile and braille
3. Character Style: As indicated on Drawings
4. Text: As indicated on Drawings.
5. Colors: High contrast, selected by Architect from manufacturer's full range.

2.6 MISCELLANEOUS INTERIOR SIGNAGE

A. Symbols of Accessibility

1. Material: Cast-acrylic, 1/4 inch reverse silk screen international symbol of accessibility in white on blue background.
2. Size: 6 inch by 6 inch.
3. Provide aluminum frame.

2.7 MATERIALS

A. Aluminum

1. Aluminum Castings: ASTM B26/B26M, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.
2. Extruded Shapes: ASTM B221 alloy 6063; size as required, or as specified by Engineer.
3. Sheet and Plate: ASTM B209 alloy 3003; mill finish as specified, for all Work which will receive a painted finish.

B. Modified Acrylic

1. Single-ply modified acrylic substrate and applique designed specifically to meet American with Disabilities (ADA) federal re

    a. Manufacturer: Rowmark “ADA Alternative Applique” or approved equal.

2. Properties:

    a. Rockwell Hardness: M45 per ASTM D-785.
    b. Deflection Temperature: 175F per ASTM D-648.

3. Finish: Matte non-glare
4. Thickness: 1/8 inch

C. Cast Acrylic Sheet

1. Microsurface cell cast acrylic (not extruded or continuous cast) for reverse engraving.

    a. Manufacturer: Rowmark “ColorCast” or approved equal.

2. Properties:

    a. Rockwell Hardness: M-100 per ASTM D-785.
    b. Deflection Temperature: 205F per ASTM D-648.

3. Carefully follow manufacturer's recommended fabrication procedures regarding expansion/contraction, fastening and restraining of acrylic plastic.
4. Thickness: 1/4 inch thick.
5. Finish: Matte, non-glare.

D. Laminated Impact Acrylic Sheet with contrasting ply:

1. Manufacturer: Rowmark “Ultramattes Reverse”
2. Finish: Matte non-glare
3. Engraving Depth: 0.012” / 0.30mm

E. Laminated Acrylic Sheet

1. Microsurfaced impact acrylic laminated with a durable UV stable polymer cap in contrasting color.

    a. Manufacturer: Rowmark “UltraGrave Matte” or approved equal.

2. Properties:

    a. Rockwell Hardness: M45 per ASTM D-785.
    b. Deflection Temperature: 175F per ASTM D-648.

3. Thickness: 1/16 inch thick.

4. Finish: Matte, non-glare.

2.8 ACCESSORIES

A. Fasteners, Hardware and Devices: Stock proprietary fastening devices of approved standard manufacture such as cadmium plated vandal resistant screws, bolts and washers, and stainless steel hinges.

1. Conceal all fasteners except where noted or shown otherwise.
2. Finish on all exposed devices to match overall sign finish, unless otherwise noted.
3. Provide vandal-resistant fasteners at all exposed locations unless otherwise noted.
4. Use fasteners fabricated from metals that are noncorrosive to either the sign material(s) or the mounting surface.

B. High Bond Double-sided Tape

1. Closed cell acrylic with foam carrier with VHB adhesive, very high solvent resistance and very high shear and peel adhesion.

    a. Manufacturer: 3M Scotch or approved equal.

2. Clear: 0.020" (#4905)
3. White: 0.045" (#4950)

C. Acrylic Polyurethane Paint

1. Acrylic polyurethane with ultraviolet inhibitors and lightfast, weather, abrasion, and graffiti resistant additives.

    a. Manufacturer: Matthews Paint Company or approved equal.

2. Prime and finish coats shall be mixed and applied in accordance with manufacturer's specifications. Paint finish shall be smooth, free of scratches, gouges, drops, bubbles, thickness variations, foreign matter or other imperfections.
3. Provide a California Title 24-compliant, matte, non-glare finish.
4. Contractor shall provide verification of paint manufacturer used for all paint work.

D. Vinyl Film

1. Opaque reflective or non-reflective vinyl film as indicated with pressure sensitive permanent adhesive backing.

    a. Manufacturer: 3M Scotchcal or approved equal.

2. All colors shall be integral and not surface applied except where custom color(s) are specified in the Drawings.
3. All custom colors shall be flood coated on white vinyl.
4. Thickness: 0.0355" minimum thickness.

2.9 TEXT, BRAILLE AND GRAPHICS

A. All text, arrows and symbols shall be provided in the sizes, colors, typefaces and spacing specified in the Drawings. All text shall be a true, clean, digitally or photomechanically accurate reproduction of the typeface(s) specified, with letter spacing, height, and directional arrows as shown in the Drawings.

B. Colors of sign graphics (text, arrows and/or symbols) shall have a minimum of 70% contrast with sign background behind graphics. Finish shall be nonglare on all sign backgrounds behind graphics on identifications and directional signs.

C. Lettering

1. Custom Typography: As shown in the Drawings**.**

D. Arrows and Symbols

1. Use digital files provided by Architect in Adobe Illustrator

E. Braille

1. All Braille shall be produced in accordance with California Title 24 requirements:

a. Dots shall be 1/10 inch (2.54 mm) on centers in each cell with 2/10 inch (5.08 mm) space between cells. Dots shall be raised a minimum of 1/40 inch (0.635 mm) above the background.

2. Contractor shall be responsible for the accurate translation of all applicable tactile text to Contracted Grade 2 Braille.

2.10 FABRICATION

A. General

1. All finished work shall be of the highest quality in order to pass eye-level examination and scrutiny by Architect.
2. Provide colors and/or finish textures as specified or indicated in the Drawings or, where not specified or indicated, as selected by Architect.

PART 3 - EXECUTION

3.1 INSPECTION

A. Architect reserves the right to inspect the Work in the Contractor's shop before it is shipped to the job site for installation.

B. Contractor shall inspect all installation locations for conditions which will adversely affect the execution, permanence and/or quality of the Work, and notify Architect in writing of

any and all unsatisfactory conditions. Contractor shall not proceed with installation until said unsatisfactory conditions have been corrected. Commencement of installation indicates acceptance of site conditions and guarantees delivery of an acceptable product.

3.2 INSTALLATION OF ROOM AND DOOR IDENTIFICATION SIGNAGE

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Accessibility: Install signs in locations on walls as indicated on Drawings and according to the accessibility standard.

C. Mounting Methods:

1. Secure to substrate with vandal resistant fasteners and silicone

3.3 SITE CLEANUP

A. Final cleanup:

1. Clean and/or repair all evidence of installation work or damage to site work or other adjacent surfaces prior to completion of work.
2. Clean up work area after all installation has been completed. Restore all disturbed ground cover.
3. Remove all protective materials and dispose of properly off site.

3.4 CLEANING AND PROTECTION

A. At completion of installation, clean all sign surfaces in accordance with manufacturer's instructions.

B. Protect all signs from damage until acceptance by Architect; repair or replace damaged units as required.

C. Clean and/or repair all evidence of installation work or damage to adjacent surfaces prior to completion of work.

D. Remove all protective materials and dispose of properly off site.

3.5 CONTRACT CLOSE-OUT ITEMS

A. Provide Owner with one quart of paint for each paint color specified.

B. Provide Owner with written instructions for proper cleaning of the signs. Note any solvents that should not be used.

END OF SECTION 101400

SECTION 102113.15 – SOLID COLOR REINFORCED COMPOSITE (SCRC) SUBSTRATE TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Solid color reinforced composite (SCRC) substrate toilet compartments configured as toilet enclosures entrance screens and urinal screens.

B. Related Requirements:
1. Section 102800 "Toilet and Bath Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories mounted on toilet compartments.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings: For toilet compartments.

1. Include plans, elevations, sections, details, and attachment details.
2. Show locations of cutouts for compartment-mounted toilet accessories.
3. Show locations of centerlines of toilet fixtures.
4. Show locations of floor drains.
5. Show ceiling grid, ceiling-mounted items, and overhead support or bracing locations.

C. Samples for Initial Selection: For each type of toilet compartment material indicated.

1. Include Samples of hardware and accessories involving material and color selection.

D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:

1. Each type of material, color, and finish required for toilet compartments, prepared on 6-inch- (152-mm-) square Samples of same thickness and material indicated for Work.
2. Each type of hardware and accessory.

E. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.

F. USA Certificate of Origin: Manufacturer shall supply with first submittal, an example of their Certificate of Origin declaring toilet compartments are wholly manufactured and assembled specifically in the United States, including city and state locations. A notarized Certificate of Origin shall be provided with closeout documents.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of toilet compartment.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 10 year experience manufacturing similar products.

B. Installer Qualifications: Minimum 2 year experience installing similar products.

C. Single Source Requirements: To the greatest extent possible provide products from a single manufacturer.

D. Accessibility Requirements: Comply with requirements applicable in the jurisdiction of the project, including but not limited to ADA and ICC/ANSI A117.1 requirements as applicable.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Door Hinges: One hinge(s) with associated fasteners.
2. Latch and Keeper: One latch(es) and keeper(s) with associated fasteners.
3. Door Bumper: One door bumper(s) with associated fasteners.
4. Door Pull: One door pull(s) with associated fasteners.
5. Door Pull: At accessible compartment doors, provide one on each side of the door.
6. Fasteners: Ten fasteners of each size and type.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

1.9 WARRANTY

A. Manufacturer's Warranty: Manufacturer's standard 25 year limited warranty for panels, doors, and stiles against breakage, corrosion, delamination, and defects in factory workmanship. Manufacturer's standard 1 year guarantee against defects in material and workmanship for stainless steel door hardware and mounting brackets.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Graffiti Resistance (ASTM D 6578): Passed cleanability test; 5 staining agents.

B. Scratch Resistance (ASTM D 2197): Maximum load value exceeds 10 kilograms.

C. Impact Resistance (ASTM D 2794): Maximum impact force exceeds 30 inch-pounds.

D. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 75 or less.
2. Smoke-Developed Index: 450 or less.

E. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA); CAC, Title 24, 2022 CBC Chapters 10 & 11B and with code provisions as adopted by authorities having jurisdiction.

2.2 SOLID COLOR REINFORCED COMPOSITE (SCRC) SUBSTRATE TOILET COMPARMENTS

A. Products: Subject to compliance with requirements, provide the following:

1. Bobrick Washroom Equipment, Inc; Sierra Series SCRC 2096G.67P
2. Or approved equal

B. Materials: Solid color reinforced composite (SCRC) material for stiles, panels, doors, and screens with anti-graffiti coating, thermoset and integrally fused into homogenous piece; high density polyethylene (HDPE), high density polypropylene not acceptable.

1. Composition: Dyes, organic fibrous material, and polycarbonate/phenolic resins.
2. Surface Treatment: Non-ghosting, graffiti resistant surface integrally bonded to core through a manufacturing steps requiring thermal and mechanical pressure.
3. Edges: Same color as the surface.
4. Color: As selected by Architect from manufacturer’s full range of colors

C. Toilet-Enclosure Style: Floor-to-ceiling with satin finish, extruded anodized aluminum headrails, 0.065 inch (1.65 mm) thick with anti-grip profile.

1. Doors and dividing panel height. Mount doors and dividing panels based on height of specified system.
   a. Door and Panel Height: as indicated on Drawings.

D. Urinal-Screen Style, 1095: Wall hung.

1. Screen Height: 81 inches x 12 inches.

E. Door, Panel, Screen, and Pilaster Construction: Solid SCRC-core panel material. Provide minimum 3/4-inch- (19-mm-) thick doors and pilasters and minimum 1/2-inch- (13-mm-) thick panels.

F. Privacy Style Partitions: No sightlines with gap-free interlocking doors and stiles routed 0.300 inches (7.6 mm) from the edge to allow for 0.175 inch (4.4 mm) overlap to prevent line-of-sight into the toilet compartment. Privacy strips fastened or adhered onto the partition material are not acceptable.

G. Pilaster Shoes and Sleeves (Caps): Formed from stainless steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.

H. Stiles: Floor-anchored stiles furnished with expansion shields and threaded rods.

1. Leveling Devices: 7 gauge, 3/16 inches (5 mm) thick, corrosion-resistant, chromate-treated, double zinc-plated steel angle leveling bar bolted to stile; furnished with 3/8 inch (10 mm) diameter threaded rods, hex nuts, lock washers, flat washers, spacer sleeves, expansion anchors, and shoe retainers.
2. Stile Shoes: One-piece, 22 gauge (0.8 mm), 18-8, Type 304 stainless steel, 4 inch (102 mm) height; tops with 90 degree return to stile. One-piece shoe capable of adapting to 3/4 inch (19 mm) or 1 inch (25 mm) stile thickness and capable of being fastened (by clip) to stiles starting at wall line.

I. Wall Posts: Pre-drilled for door hardware, 18-8, Type 304, 16 gauge (1.6 mm) stainless steel with satin finish; 1 inch (25 mm) x 1-1/2 inches (38 mm) x 58 inches high (1473 mm).

J. Anchors: Expansion shields and threaded rods at floor connections as applicable. Threaded rods secured to supports above ceiling as applicable. Supports above ceiling furnished and installed as Work of Section 05 50 00 - Metal Fabrications.

2.3 HARDWARE AND ACCESSORIES

A. Hardware and Accessories: Manufacturer's heavy-duty operating industrial hardware and accessories. Chrome-plated “Zamak” aluminum. Extruded plastic hardware not acceptable.

1. Compliance: Operating force of less than 5 lb (2.25 kg).

2. Emergency Access: Hinges, door latch allow door to be lifted over keeper from outside compartment on inswing doors.
3. Materials: 18-8, Type 304, heavy-gauge stainless steel with satin finish.
4. Doorstops: Prevents inswinging doors from swinging out beyond stile; on outswing doors, doorstop prevents door from swinging in beyond stile.
5. Fastening: Hardware secured to door and stile by through-bolted, theft-resistant, pin-in-head Torx stainless steel machine screws into factory-installed, threaded brass inserts. Fasteners secured directly into core not acceptable.

    a. Threaded Brass Inserts: Factory-installed; withstand direct pull force exceeding 1500 lb (680 kg) per insert.

6. Clothes Hooks: Projecting no more than 1-1/8 inch (29 mm) from face of door.
7. Door Latch: Track of door latch prevents inswing doors from swinging out beyond stile; on outswing doors, door keeper prevents door from swinging in beyond stile; 16 gauge (1.6 mm) sliding door latch, 14 gauge (2 mm) keeper.
8. Door Pull: At accessible compartment doors, provide one on each side of the door.
9. Locking: Door locked from inside by sliding door latch into keeper.
10. Hinge Type:

    a. Full-Height Institutional Hinge.

        1) Hinges: 16 gauge (1.6 mm) stainless steel, self-closing, 3 section continuous hinges.

11. Mounting Brackets:

    a. Full-Height Continuous.

        1) Mounting Brackets: 18 gauge (1.2 mm) stainless steel and extend full height of panel.
        2) U-Channels: Secure panels to stiles.
        3) Angle Brackets: Secure stiles-to-walls and panels to walls.

B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 MATERIALS

A. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.

B. Stainless Steel Castings: ASTM A743/A743M.

C. Zamac: ASTM B86, commercial zinc-alloy die castings.

2.5 FABRICATION

A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

B. Floor-to-ceiling Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

C. Door Size and Swings: Unless otherwise indicated, provide 24-inch- (610-mm-) wide in-swinging doors for standard toilet compartments and 36-inch- (914-mm-) wide out-swinging doors with a minimum 32-inch- (813-mm-) wide clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.

1. Confirm location and adequacy of blocking and supports required for installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions.

1. Verify blocking and supports in walls and ceilings has been installed properly at points of attachment.
2. Verify location does not interfere with door swings or use of fixtures.
3. Use fasteners and anchors suitable for substrate and project conditions
4. Install units rigid, straight, plumb, and level.
5. Conceal evidence of drilling, cutting, and fitting to room finish.
6. Test for proper operation.

B. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

a. Pilasters and Panels: 1/2 inch (13 mm).
b. Panels and Walls: 1 inch (25 mm).

2. Full-Height Continuous Brackets: Secure panels to walls and to pilasters with full-height brackets.

    a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
    b. Align brackets at pilasters with brackets at walls.

C. Floor-to-ceiling Units: Set pilasters with anchors penetrating not less than 2 inches (51 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.

D. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.3 ADJUSTING, CLEANING AND PROTECTION

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

B. Touch-up, repair or replace damaged products.

C. Clean exposed surfaces of compartments, hardware, and fittings.

END OF SECTION 102113.17

SECTION 102600 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Abuse-resistant wall coverings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For each type of wall and door protection showing locations and extent.

   1. Include plans, elevations, sections, and attachment details.

C. Samples for Initial Selection: For each type of impact-resistant wall-protection unit indicated, in each color and texture specified.

   1. Include Samples of accent strips and accessories to verify color selection.

D. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:
   1. Abuse-Resistant Wall Covering: 6 by 6 inches (150 by 150 mm) square.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of handrail.

B. Material Certificates: For each type of exposed plastic material.

C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Wall-Guard Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of cover installed, but no fewer 2 than long units.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 deg F (21 deg C) during the period plastic materials are stored.
2. Keep plastic materials out of direct sunlight.
3. Store plastic wall- and door-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F (21 deg C).

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain wall- and door-protection products of each type from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

2.3 ABUSE-RESISTANT WALL COVERINGS – **FRP**

A. Abuse-Resistant Sheet Wall Covering: Fabricated from semirigid, plastic sheet wall-covering material.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Construction Specialties, Inc.
b. Korogard Wall Protection Systems; a division of RJF International Corporation.
c. Or approved equal

2. Size: 48 by 96 inches (1219 by 2438 mm) for sheet.
3. Sheet Thickness: 0.060 inch (1.5 mm).
4. Color and Texture: As selected by Architect from manufacturer's full range.
5. Height: As indicated on Drawings
6. Trim and Joint Moldings: Extruded rigid plastic that matches wall-covering color.
7. Mounting: Adhesive.

2.4 MATERIALS

A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.

B. Adhesive: As recommended by protection product manufacturer.

2.5 FABRICATION

A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.6 FINISHES

A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances, fire rating, and other conditions affecting performance of the Work.

B. Examine walls to which wall and door protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

1. For wall and door protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

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

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing wall and door protection.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

B. Mounting Heights: Install wall and door protection in locations and at mounting heights indicated on Drawings.

C. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.

1. Provide anchoring devices and suitable locations to withstand imposed loads.
2. Where splices occur in horizontal runs of more than 20 feet (6.1 m), splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches (305 mm) apart.
3. Adjust end and top caps as required to ensure tight seams.

D. Abuse-Resistant Wall Covering: Install top and edge moldings, corners, and divider bars as required for a complete installation.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600

SECTION 102800 – TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Hand dryers.
3. Underlavatory guards.

B. Related Requirements:

1. Section 079200 “Joint Sealants” for interior sanitary joint sealant.

1.3 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Include electrical characteristics.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify accessories using designations indicated.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranties.

1.6 QUALITY ASSURANCE

A. Source Limitations: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise approved by Architect.

B. Product Options: Accessory requirements, including those for materials, finishes, dimensions, capacities, and performance, are established by specific products indicated in the Toilet and Bath Accessory Schedule.

1. Products of other manufacturers listed in Part 2 with equal characteristics, as judged solely by Architect, may be provided.
2. Do not modify aesthetic effects, as judged solely by Architect, except with Architect's approval. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.8 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, visible silver spoilage defects.
2. Warranty Period: 15 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Hand Dryers: Manufacturer agrees to repair or replace hand dryers that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 OWNER-FURNISHED MATERIALS

A. Owner-Furnished Materials: electronic paper towel dispensers, roll paper towel dispensers, soap dispensers.

2.2 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Structural Performance: Design accessories and fasteners to comply with the following requirements:

1. Grab Bars: Installed units are able to resist 250 lbf (1112 N) concentrated load applied in any direction and at any point.

C. Accessibility Standard: For toilet and bath accessories indicated to be accessible, comply with the Americans with Disabilities Act (ADA); CAC, Title 24, 2022 CBC Chapters 10 & 11B and with code provisions as adopted by authorities having jurisdiction.

2.3 PUBLIC-USE WASHROOM ACCESSORIES

A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.

B. Toilet Tissue (Roll) Dispenser:

1. Products: Subject to compliance with requirements, provide the following:

a. Kimberly-Clark #9608 Black Item #10237895

2. Description: Double-roll dispenser.
3. Mounting: Surface mounted.
4. Capacity: Designed for 9.38 inch diameter tissue rolls.
5. Material and Finish: plastic.

C. ADA Toilet Tissue (Roll) Dispenser:

1. Products: Subject to compliance with requirements, provide the following:

a. Bobrick Washroom Equipment, Inc; B-3888

2. Description: Single roll
3. Mounting: Semi-recessed.
4. Operation: Stainless steel unit with pivot hinge, tumbler lock
5. Capacity: Designed for 5-inch- (127-mm-) diameter tissue rolls.
6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

D. Paper Towel Dispenser, folded:

1. Products: Subject to compliance with requirements, provide the following:

a. Bobrick Washroom Equipment, Inc; B-262

2. Mounting: Semirecessed.
3. Minimum Capacity: 400 C-fold or 525 multifold towels.
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
5. Lockset: Tumbler type.
6. Refill Indicator: Pierced slots at sides.

E. Paper Towel Dispenser, electronic:

1. Products: Subject to compliance with requirements, provide the following:

   a. Tork 5551028

2. Mounting: Surface.

F. Paper Towel Dispenser, roll:

1. Products: Subject to compliance with requirements, provide the following:

   a. Reliable Brand Translucent Black Towel Roll Dispenser Item #10747267 MFG 422939

2. Mounting: Surface.

3. Finish: Plastic.

G. Waste Receptacle:

1. Products: Subject to compliance with requirements, provide the following:

   a. Bobrick Washroom Equipment, Inc; B-3644

2. Mounting: Open top, recessed.
3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
4. Liner: Reusable vinyl liner.
5. Lockset: Tumbler type for waste receptacle.

H. Soap Dispenser:

1. Products: Subject to compliance with requirements, provide the following:

   a. Kimberly-Clark Soap Dispenser #91245 Black Item #10406988

2. Description: Designed for manual operation and dispensing soap in liquid or lotion form. Push type soap valve, check valve.
3. Materials: Plastic

I. Grab Bar:

1. Products: Subject to compliance with requirements, provide the following:

a. Bobrick Washroom Equipment, Inc; B-6806

2. Mounting: Snap flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.

a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin).

4. Outside Diameter: 1-1/4 inches (32 mm).
5. Configuration and Length: As indicated on Drawings.

J. Sanitary-Napkin and Tampon Vendor:

1. Products: Subject to compliance with requirements, provide the following:

a. Bobrick Washroom Equipment, Inc; B-370634

2. Mounting: Semi-recessed.
3. Operation: Free, per Assembly Bill 367.
4. Exposed Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
5. Lockset: Tumbler type with separate lock and key for coin box.

K. Sanitary-Napkin Disposal Unit:

1. Products: Subject to compliance with requirements, provide the following:

a. Bobrick Washroom Equipment, Inc; B-270

2. Mounting: Surface mounted.
3. Door or Cover: Self-closing, disposal-opening cover and hinged face panel with tumbler lockset.
4. Receptacle: Removable.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

L. Seat-Cover Dispenser:

1. Products: Subject to compliance with requirements, provide the following:

a. Bobrick B-4221

2. Mounting: Surface mounted.

3. Material: Satin finish.

M. Mirror Unit:

1. Products: Subject to compliance with requirements, provide the following:

a. Bobrick Washroom Equipment, Inc; B-165

2. Frame: Stainless steel angle, 0.05 inch (1.3 mm) thick.

a. Corners: Welded and ground smooth.

3. Size: as indicated in drawings.
4. Hangers: Manufacturer's standard rigid, tamper and theft resistant.

2.4 HAND DRYERS

A. Source Limitations: Obtain hand dryers from single source from single manufacturer.

B. Warm-Air Dryer:

1. Product: Bobrick B-7128
2. Description: Standard-speed, warm-air hand dryer.
3. Mounting: Surface mounted.

a. Protrusion Limit: Installed unit protrudes maximum 4 inches (102 mm) from wall surface.

4. Operation: Infrared-sensor activated with timed power cut-off switch.

a. Automatic Shutoff: At 120 seconds.

5. Electrical Requirements: 115 V, 13 A, 1500 W.

2.5 UNDERLAVATORY GUARDS

A. Underlavatory Guard:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Buckaroos, Inc.
b. Plumberex Specialty Products, Inc.
c. Truebro by IPS Corporation.

2. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
3. Material and Finish: Antimicrobial, molded plastic, white.

2.6 MATERIALS

A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch- (0.8-mm-) minimum nominal thickness unless otherwise indicated.

B. Brass: ASTM B19, flat products; ASTM B16/B16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B30, castings.

C. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), 0.036-inch- (0.9-mm-) minimum nominal thickness.

D. Galvanized-Steel Sheet: ASTM A653/A653M, with G60 (Z180) hot-dip zinc coating.

E. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.

F. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Section, and tamper and theft resistant where exposed, and of stainless or galvanized steel where concealed.

G. Chrome Plating: ASTM B456, Service Condition Number SC 2 (moderate service).

H. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.7 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

1. Remove temporary labels and protective coatings.

B. Grab Bars: Install to comply with specified structural-performance requirements.

C. Mirrors: Secure mirrors to walls in concealed, tamper-proof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, in accordance with manufacturer's instructions for type of substrate involved.

D. Fit flanges of accessories snug to wall surfaces. Install sanitary sealant in gaps between 90-degree return flanges and finish wall surface after installation.

E. Finish edges of accessories with sealant to avoid water penetration.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION 102800

SECTION 122200 – PRIVACY CURTAIN AND TRACK

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 SECTION INCLUDES

A. Curtain Track

B. Cubicle Curtains

1.3 REFERENCES

A. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.

1.4 DESIGN / PERFORMANCE REQUIREMENTS

A. Curtain Materials: Conform to NFPA 701, small scale fire test.

1.5 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used and:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

B. Shop Drawings: Reflected ceiling plan layout of curtain track, track suspension points, track attachment details, number of carriers, curtain sizes, and accessories.

C. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors, patterns and opening sizes.

E. Verification Samples: For each finish product specified, two samples, representing actual products.

1. Curtain: 12 by 12 inch (300 mm by 300 mm) sample patch of actual fabric material selected with representative acoustical channel fabrication, hem stitch detail, mesh heading with reinforcement, and carrier attachment to curtain header.

2. Curtain Track and Anchors: Approximately 6 inch (150 mm) long samples illustrating finish.

F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

G. Closeout Submittals: Provide manufacturer’s maintenance instructions that include recommendations for care and cleaning of components.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in work of this Section with minimum 5 years documented experience.

B. Installer Qualifications: Company specializing in work of this Section with minimum 3 years documented experience.

C. Flammability: Curtains shall pass NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store and handle in strict compliance with manufacturer's instructions and recommendations

B. Deliver materials and products in undamaged and unopened factory labeled packages.

C. Store products in manufacturer's unopened packaging with labels intact until ready for installation.

1.8 SEQUENCING

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.9 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.10 WARRANTY

A. Provide the manufacturer’s 25 year limited warranty for mounting hardware, headbox, clutch, fascia, shade fabric, valance, curtain grommets, curtain and curtain track.

B. Provide the manufacturer's 5 year limited warranty for controls, electronic accessories and motors.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: American Drapery Systems, Inc.; 676 Mendelssohn Ave N, Golden Valley, MN 55427. Toll Free: 1-866-797-9462, Local: (952) 797-9462, Fax: (952) 797-7453, Email: info@americandraperysystems.com. Web: www.americandraperysystems.com.

B. Or approved equal.

2.2 CURTAIN TRACK

A. Commercial Aluminum Curtain Track: Heavy duty straight or curved cubicle curtain and track system with double wheel and hook carriers as manufactured by American Track & Supply with the following characteristics:

1. Track:

a. Extruded aluminum.

b. Dimensions: 3/4 inches high (19 mm) by 3/4 (19 mm) inch wide.

2. Carriers: Provide 4 carriers per lineal foot.

3. Mounting: Ceiling mounted.

4. Mount Type: Provide straight and bent sections as indicated on Drawings.

5. Track Accessories: Provide with splices, connectors, hangers, anchors and mounting plates as required.

2.3 PRIVACY CURTAINS

A. Privacy Curtains made from hospital quality material. Material shall be antimicrobial for infection control, flame retardant meeting NFPA 701 requirements and stain resistant.

1. Curtains to have stainless steel grommets spaced 6 inches apart.

2. Side seams and bottom seams to be 1 inch double, with center seams also double sewn.

3. Curtains to be made 15% wider than the track size to allow for fullness.

4. Bottom hem to be 12 inches above finished floor.

5. Fabric: As selected by Architect from Manufacturer’s standard fabrics.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Verify that ceiling support system is ready to receive work of this Section.

C. Verify dimensions prior to fabrication with field measurements.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Installation of Cubicle Curtains and Tracks: Install in accordance with manufacturer’s recommendations, including the following:

1. Verify that ceilings are suitable for installation prior to installation.

2. Mechanically attach tracks using manufacturer’s recommended anchors and attachment devices.

3. Install accessories and curtains and test for proper operation. Replace damaged units.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 21 00 50 - BASIC FIRE SPRINKLER MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Access doors.
2. Expansion loops.
3. Insulation.

1.2 RELATED REQUIREMENTS

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

B. This Section is part of each Division 21 Section.

1.3 ADDITIONAL REQUIREMENTS

A. Furnish and install incidental work not shown or specified necessary to provide a complete and workable system.

B. Make temporary connections required to maintain services during the course of the Contract without additional cost to Owner. Notify Owner seven days in advance before interrupting services.

1.4 REFERENCES AND STANDARDS

A. Where material or equipment is specified to conform to referenced standards, it shall be assumed that the most recent edition of the standard in effect at time of bid shall be used.

1. ANSI - American National Standards Institute.
2. ASME - American Society of Mechanical Engineers.
3. ASTM - American Society for Testing and Materials.
4. CCR - California Code of Regulations.

    a. Title 8 - Division of Industrial Safety, Subchapter 7; General Industry Safety Orders, Articles 31 through 36.

5. NCPWB - National Certified Pipe Welding Bureau.
6. CEC - California Electrical Code.
7. NEMA - National Electrical Manufacturers' Association.
8. NFPA - National Fire Protection Association, as amended by the CBC.

9. OSHA - Occupational Safety and Health Act.
10. UL - Underwriters' Laboratories, Inc.

B. Requirements of Regulatory Agencies:

1. The publications listed below form part of this Specification. Comply with provisions of these publications except as otherwise shown or specified.

a. California Building Code, 2022.
b. California Electrical Code, 2022.
c. California Energy Code, 2022.
d. California Fire Code, 2022.
e. California Green Building Standards Code, 2022.
f. California Mechanical Code, 2022.
g. California Plumbing Code, 2022.
h. California Code of Regulations, Title 24.
i. California Health and Safety Code.
j. CAL-OSHA.
k. California State Fire Marshal, Title 19 CCR.
l. DSA - Division of the State Architect. Interpretive Regulations (IR's).
m. National Fire Protection Association, as amended by the CBC.
n. Occupational Safety and Health Administration.
o. Other applicable state laws.

2. Nothing in Drawings or Specifications shall be construed to permit work not conforming to these codes, or to requirements of authorities having jurisdiction. It is not the intent of Drawings or Specifications to repeat requirements of codes except where necessary for clarity.

1.5 DRAWINGS

A. Examine Contract Documents prior to bidding of Work and report discrepancies in writing to Architect.

B. Drawings showing location of equipment and materials are diagrammatic and job conditions will not always permit installation in location shown. The fire protection Drawings show general arrangement of equipment and materials, etc., and shall be followed as closely as existing conditions, actual building construction, and work of other trades permit.

1. Architectural and structural Drawings are part of the Work. These Drawings furnish Contractor with information relating to design and construction of the Project. Architectural Drawings take precedence over fire protection Drawings.
2. Because of the small scale of fire protection Drawings, not all offsets, fittings, and accessories required are shown. Investigate structural and finish conditions affecting the Work and arrange Work accordingly. Provide offsets, fittings, and accessories required to meet conditions. Inform Architect immediately when job conditions do not permit installation of equipment and materials in locations shown. Obtain Architects' approval prior to relocation of equipment and materials.

3. Relocate equipment and materials installed without prior approval of Architect. Remove and relocate equipment and materials at Contactors' expense upon Architects' direction.
4. Minor changes in locations of equipment, piping, ducts, etc., from locations shown shall be made when directed by the Architect at no additional cost to the Owner providing such change is ordered before such items of work, or work directly connected to same are installed and providing no additional material is required.

C. Execute work mentioned in Specifications and not shown on Drawings, or vice versa, the same as if specifically mentioned or shown in both.

1.6 FEES AND PERMITS

A. Obtain and pay for permits and service required in installation of the Work. Arrange for required inspections and secure approvals from authorities having jurisdiction. Comply with the requirements of Division 01.

B. Arrange for utility connections and pay charges incurred, including excess service charges.

1. Bear the cost of construction related to utility services, from point of connection to utility services shown on Contract Documents. This includes piping, excavation, backfill, meters, boxes, check valves, backflow prevention devices, general service valves, concrete work, and the like, whether or not Work is performed by Contractor, local water/sanitation district, public utility, other governmental agencies or agencies' assigns.

C. Obtain permits to operate compressed air tanks required to be furnished as part of this Work. Pay costs, and perform tests required to obtain permits. Post permits framed under glass in a conspicuous place on or near tanks, or as required by authorities having jurisdiction.

1.7 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General:

a. Coordinate Work in this Section with trades covered in other Specification Sections to provide a complete and operable installation of highest quality workmanship.

2. Electrical Coordination:

a. Refer to the Electrical Drawings and Specifications, Division 26, for service voltage and power feed wiring for equipment specified in this Section. Contractor has full responsibility for the following items of work:

1) Review the Electrical Drawings and Division 26 Specifications to verify that electrical services provided are adequate and compatible with equipment requirements.
2) If additional electrical services are required above that indicated on Electrical Drawings and in Division 26, such as more control interlock conductors, larger feeder, or separate 120 volt control power source, include cost to furnish and install additional electrical services as part of bid.
3) Prior to proceeding with installation of additional electrical work, submit detailed drawings indicating exact scope of additional electrical work.

3. Mechanical Coordination:

a. Arrange for pipe spaces, chases, slots and openings in building structure during progress of construction, to accommodate mechanical system installation.
b. Coordinate installation of supporting devices. Set sleeves in poured-in-place concrete and other structural components during progress of construction.
c. Coordinate requirements for access panels and doors for mechanical items requiring access where concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section “Access Doors and Frames.”

1.8 SUBMITTALS - GENERAL

A. Refer to Division 01 Submittals Section(s) for additional requirements.

B. Provide submittal of materials proposed for use as part of this Project. Product names in Specifications and on Drawings are used as standards of quality. Furnish standard items on specified equipment at no extra cost to the Contract regardless of disposition of submittal data. Other materials or methods shall not be used unless approved in writing by Architect. Architect's review will be required even though "or equal" or synonymous terms are used.

1. Partial or incomplete submittals will not be reviewed.
2. Quantities are Contractor's responsibility and will not be reviewed.
3. Provide materials of same brand or manufacturer for each class of equipment or material.
4. Identify each item by manufacturer, brand, trade name, number, size, rating, or other data necessary to properly identify and review materials and equipment. Words "as specified" are not sufficient identification.
5. Identify each submittal item by reference to items’ Specification Section number and paragraph, by Drawing and detail number, and by unit tag number.
6. Organize submittals in same sequence as in Specification Sections.
7. Show physical arrangement, construction details, finishes, materials used in fabrications, provisions for piping entrance, access requirements for installation and maintenance, physical size, mechanical characteristics, foundation and support details, and weight.

a. Submit shop drawings, performance curves, and other pertinent data, showing size and capacity of proposed materials.

b. Specifically indicate, by drawn detail or note, that equipment complies with each specifically stated requirement of Contract Documents.
c. Drawings shall be drawn to scale and dimensioned (except schematic diagrams). Drawings may be prepared by vendor but must be submitted as instruments of Contractor, thoroughly checked and signed by Contractor before submission to Architect for review.
d. Catalog cuts and published material may be included with supplemental scaled drawings.

C. Review of submittals will be only for general conformance with design concept and general compliance with information given in Contract Documents. Review will not include quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with work of other trades, or construction safety precautions, which are sole responsibility of Contractor. Review of a component of an assembly does not indicate acceptance of an assembly. Deviations from Contract Documents not clearly identified by Contractor are Contractor's responsibility and will not be reviewed by Architect.

D. Within reasonable time after award of contract and in ample time to avoid delay of construction, submit to Architect shop drawings or submittals on all items of equipment and materials provided. Provide submittal in at least seven copies and in complete package.

1. Shop drawings and submittals shall include Specification Section, Paragraph number, and Contract Drawing unit symbol or detail number for reference. Organize submittals into booklets for each Specification section and submit in loose-leaf binders with index. Deviations from Contract Documents shall be clearly identified and appear at the beginning of submittal package and shall be referenced to applicable Contract Documents requirements.

E. Furnish to Project Inspector complete installation instructions on material and equipment before starting installation.

1.9 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for fire protection systems materials and products.

B. Shop Drawings.

C. Provide product data for insulation products, including insulation, insulation facings, jackets, adhesives, sealants, and coatings, indicating compliance with requirement that these products contain less than 0.1 percent (by mass) polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations.

D. Product Data for California Green Building Standards Code Compliance: For adhesives and sealants, including primers, documentation of compliance including printed statement of VOC content and chemical components.

1.10 INFORMATIONAL SUBMITTALS

A. Provide coordination drawings for fire protection systems in accordance with the requirements of Specification Section 21 10 00.

B. Provide layouts for fire protection systems, for inclusion in coordinated layout specified in Section 23 80 00. Comply with requirements for layouts specified in Section 23 80 00.

1.11 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Refer to Division 01 for complete instructions.
2. Furnish three complete sets of Operating and Maintenance Manual bound in hardboard binder, and one compact disc containing complete Operating and Maintenance Manual in searchable PDF format. Provide Table of Contents. Provide index tabs for each piece of equipment in binder and disc. Start compiling data upon approval of submittals.

a. Sets shall incorporate the following:

1) Product Data.
2) Shop Drawings.
3) Record Drawings.
4) Service telephone number, address and contact person for each category of equipment or system.
5) Complete operating instructions for each item of fire sprinkler system.

a) Original manual of NFPA-25 for fire sprinkler system.

6) Copies of guarantees/warrantees for each item of equipment or systems.
7) Test data as specified.
8) Typewritten maintenance instructions for each item of equipment listing lubricants to be used, frequency of lubrication, inspections required, adjustment, etc.
9) Manufacturers' bulletins with parts numbers, instructions, etc., for each item of equipment.
10) A complete list or schedule of scheduled valves giving the number of the valve, location and the rooms or area controlled by the valve. Identify each valve with a permanently attached metal tag stamped with number to match schedule. Post list in frame under plastic on wall in mechanical room or where directed by Architect.
11) Check test and start reports for each piece of fire protection equipment provided as part of the Work.
12) Commissioning and Preliminary Operation Tests required as part of the Work.

b. Post service telephone numbers and addresses in an appropriate place designated by Architect.

B. Record Drawings:

1. Refer to Division 01, Record Documents, for requirements governing Work specified herein.
2. Upon completion of the work, deliver to Architect the following:

a. Originals of drawings showing the Work exactly as installed.
b. One complete set of reproducible drawings showing the Work exactly as installed.
c. One compact disc with complete set of drawings in PDF format showing the Work exactly as installed.
d. Provide Contractor's signature, verifying accuracy of record drawings.
e. Obtain the signature of the Project Inspector for all record drawings.

1.12 SUBSTITUTIONS

A. Refer to Division 01 for complete instructions. Requirements given below are in addition to or are intended to amplify Division 01 requirements. In case of conflict between requirements given in this Section and those of Division 01, Division 01 requirements shall apply.

B. It is the responsibility of Contractor to assume costs incurred because of additional work and or changes required to incorporate proposed substitute into the Project. Refer to Division 01 for complete instructions.

C. Substitutions will be interpreted to be manufacturers other than those specifically listed in Contract Documents by brand name, model, or catalog number.

D. Only one request for substitution will be considered for each item of equipment or material.

E. Substitution requests shall include the following:

1. Reason for substitution request.
2. Complete submittal information as described herein; see "Submittals."
3. Coordinated scale layout drawings depicting position of substituted equipment in relation to other work, with required clearances for operation, maintenance and replacement.
4. List optional features required for substituted equipment to meet functional requirements of the system as indicated in Contract Documents.
5. Explanation of impact on connected utilities.
6. Explanation of impact on structural supports.

F. Installation of reviewed substitution is Contractors' responsibility. Any mechanical, electrical, structural, or other changes required for installation of substituted equipment or material must be made by Contractor without additional cost to Owner. Review by Architect of substituted equipment or material, will not waive these requirements.

G. Contractor may be required to compensate Architect for costs related to substituted equipment or material.

1.13 DELIVERY, STORAGE AND HANDLING

A. Protect equipment and materials delivered to Project site from weather, humidity and temperature variations, dirt, dust and other contaminants.

1.14 FIELD CONDITIONS

A. Contractor shall visit Project site and examine existing conditions in order to become familiar with Project scope. Verify dimensions shown on Drawings at Project site. Bring discrepancies to the attention of Architect. Failure to examine Project site shall not constitute basis for claims for additional work because of lack of knowledge or location of hidden conditions that affect Project scope.

B. Information on Drawings relative to existing conditions is approximate. Deviations from Drawings necessary during progress of construction to conform to actual conditions shall be approved by Architect and shall be made without additional cost to Owner. The Contractor shall be held responsible for damage caused to existing services. Promptly notify Architect if services are found which are not shown on Drawings.

1.15 WARRANTY

A. Refer to Division 01 for warranty requirements, and duration and effective date of Contractor’s Standard Guarantee.

B. Repair or replace defective work, material, or part that appears within warranty period, including damage caused by leaks.

C. On failure to comply with warranty requirements within a reasonable length of time after notification is given, Architect/Owner shall have repairs made at Contractor's expense.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials or equipment of the same type shall be of the same brand wherever possible. All materials shall be new and in first class condition.

B. All sizes, capacities, and efficiency ratings shown are minimum.

C. Refer to Section 21 10 00 for specific system piping materials.

2.2 MATERIALS

A. No material installed as part of this Work shall contain asbestos.

B. California Green Building Code Compliance:

1. Fire protection equipment shall not contain CFCs.
2. Fire protection equipment shall not contain Halons.

2.3 ACCESS DOORS

A. Where floors, walls, or ceilings must be penetrated for access to fire protection equipment or devices, provide access doors, 14 inch by 14 inch minimum size in usable opening. Where entrance of a serviceman may be required, provide 20 inch by 30 inch minimum usable opening. Locate access doors/panels for non-obstructed and easy reach.

1. Access doors less than 7'-0" above floors and exposed to public access shall have keyed locks.

B. Access doors shall match those supplied in Division 08, except as noted in this Section.

C. Provide stainless steel access doors for use in toilet rooms, shower rooms, kitchens and other damp areas. Provide steel access doors with prime coat of baked-on paint for other areas.

D. Do not locate access doors in highly visible public areas such as lobbies, waiting areas, and primary entrance areas. Coordinate with Architect when access is required in these areas.

E. Where specific information or details relating to access panels different from the above is shown or given on Drawings or other Divisions of work, that information shall supersede this specification.

F. Manufacturers: Subject to compliance with requirements, available manufacturers offering products which may be incorporated into the Work include Milcor, Karp, Nystrom, or Cesco, equal to the following:

1. Milcor:

a. Style K (plaster)
b. Style DW (gypsum board)
c. Style M (masonry)
d. Style "Fire Rated" where required

2.4 EXPANSION LOOPS

A. Manufactured assembly consisting of inlet and outlet elbow fittings, two sections of flexible metal hose and braid, and 180-degree return bend or center section of flexible hose. Flexible hose shall consist of corrugated metal inner hose and braided outer sheath. Provide UL listed assembly selected for 4 inches of movement.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Metraflex Inc., Fireloop series.
2. Unisource Manufacturing, Inc., V series.

2.5 EQUIPMENT IDENTIFICATION

A. Identify each piece of equipment with a permanently attached engraved bakelite plate, 1/2 inch high white letters on black background.

B. Text of Signs: Provide identification of equipment unit number, and room or area served. Coordinate name of area served with final room names and numbers for the facility. In addition, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

2.6 PIPE IDENTIFICATION

A. Identify each piping system and indicate the direction of flow by means of Seton, Inc., Marking Services Inc., Reef Industries, Inc., or equal, pre-tensioned, coiled semi-rigid plastic pipe labels formed to circumference of pipe, requiring no fasteners or adhesive for attachment to pipe.

B. The legends and flow arrows shall conform to ASME A13.1.

2.7 INSULATION WORK

A. General:

1. Adhesives shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.
2. The term "piping" used herein includes pipe, valves and fittings.

    a. Apply insulating cement to fittings, valves and strainers and trowel smooth to equal the thickness of adjacent covering. Cover with jacket to match piping. Extend covering on valves up to bonnet. Leave strainer cleanout plugs accessible.
    b. Provide pre-formed PVC valve and fitting covers.
    c. Provide Calcium Silicate rigid insulation and sheet metal sleeve, 18 inch minimum length at each pipe hanger. Seal ends of insulation to make vapor tight with jacket.

3. Test insulation, jackets, and lap-seal adhesives as a composite product and confirm flame spread of not more than 25 and a smoke developed rating of not more than 50 when tested in accordance with UL723, ASTM E84, or NFPA 255.
4. Clean thoroughly, test and have approved, piping and equipment before installing insulation and/or covering.
5. Repair damage to existing pipe insulation whether or not caused during Work of the Contract, to match existing adjacent insulation for thickness and finish, but conforming to flame spread and smoke ratings specified above.

B. Insulation of Piping:

1. Insulate fire protection piping located outside building exposed to weather with minimum 3-1/2 pounds per cubic foot density fiberglass with ASJ-SSL jacket. Insulation thickness for all pipe sizes: 2 inches.
2. Where insulated piping is exposed to the weather apply aluminum jacket secured with 1/2-inch stainless-steel bands on 12-inch centers. Insulation shall be vapor tight before applying metal jacket, and aluminum fitting covers. Install jacketing with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Cover fittings with glass cloth, two coats of Foster Sealfas 30-36, and factory-fabricated aluminum fitting covers, of same material, finish, and thickness as jacket. Insulation shall be vapor tight before applying metal jacket and fitting covers.

    a. Fitting covers:

        1) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
        2) Tee covers.
        3) Flange and union covers.
        4) End caps.
        5) Beveled collars.
        6) Valve covers.
        7) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

    b. Pipes 10 inches diameter and smaller: Minimum .016-inch-thick jacket.
    c. Pipes 12 inches diameter and larger: Minimum .020-inch-thick jacket.

PART 3 - EXECUTION

3.1 EXISTING MATERIALS

A. Remove existing equipment, piping, wiring, construction, etc., which interferes with Work of this Contract. Promptly return to service upon completion of work in the area. Replace items damaged by Contractor with new material to match existing.

B. Removed materials which will not be reinstalled, and which are not claimed by Owner shall become property of Contractor and shall be removed from Project site. Consult Owner before removing any material from Project site. Carefully remove materials claimed by Owner to prevent damage and deliver to Owner-designated storage location.

C. Existing piping and wiring not reused and are concealed in building construction may be abandoned in place and all ends shall be capped or plugged. Remove unused piping and wiring exposed in Equipment Rooms or occupied spaces. Material shall be removed from Project premises. Disconnect power, water, gas, pump or any other active energy source from piping or electrical service prior to abandoning in place.

D. Existing piping and equipment modified or altered as part of this Work shall comply with the most recent applicable code requirements.

3.2 FRAMING, CUTTING AND PATCHING

A. Special framing, recesses, chases and backing for Work of this Section, unless otherwise specified, are covered under other Specification Sections.

B. Contractor is responsible for placement of pipe sleeves, hangers, inserts, supports, and location of openings for the Work.

C. Cutting, patching, and repairing of existing construction to permit installation of equipment, and materials is responsibility of Contractor. Repair or replace damage to existing work with skilled mechanics for each trade.

D. Cut existing concrete construction with a concrete saw. Do not utilize pneumatic devices.

E. Core openings through existing construction for passage of new piping and conduits. Cut holes of minimum diameter to suit size of pipe and associated insulation installed. Coordinate with building structure, and obtain Structural Engineer's approval prior to coring through existing construction.

3.3 DEMOLITION

A. Refer to Division 01 Sections “Cutting and Patching” and/or “Selective Demolition” for general demolition requirements and procedures.

B. Disconnect, dismantle and remove fire protection systems, equipment, and components indicated to be removed. Coordinate with all other trades.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping to remain with same or compatible piping material.
3. Equipment to Be Removed: Drain down and cap remaining services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.4 ELECTRICAL REQUIREMENTS

A. Provide adequate working space around electrical equipment in compliance with the California Electrical Code. Coordinate the fire protection Work with the electrical Work to comply.

B. Furnish necessary control diagrams and instructions for controls. Before permitting operation of equipment which is furnished, installed, or modified under this Section, Contractor shall review associated electrical work, including overload protection devices, and assume complete responsibility for correctness of electrical connections and protective devices. Motors and control equipment shall conform to the Standards of the National Electrical Manufacturers' Association. Equipment and connections exposed to weather shall be installed in NEMA IIIR enclosures with factory wired strip heaters in each starter enclosure and temperature control panel where required to inhibit condensation.

C. All line voltage and low voltage wiring and conduit associated with fire protection system are included in this Section. Wiring and conduit shall comply with Division 26.

3.5 PIPING SYSTEM REQUIREMENTS

A. Drawing plans, schematic and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

3.6 PRIMING AND PAINTING

A. Perform priming and painting on the equipment and materials as specified herein.

B. See Division 09 Painting Section(s) for detailed requirements.

C. Priming and Painting:

1. Exposed ferrous metals, including piping, which are not galvanized or factory-finished shall be primed and painted.

    a. Black Steel Piping:

        1) Primer: One coat gray Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, comparable products by Rust-Oleum, Kelly Moore, or equal.
        2) Topcoat: Two coats gray Sherwin-Williams Pro Industrial Waterbased Alkyd Urethane Enamel, comparable products by Rust-Oleum, Kelly Moore, or equal.

2. Metal surfaces of items to be jacketed or insulated except piping shall be given two coats of primer unless furnished with equivalent factory finish. Items to be primed shall be properly cleaned by effective means free of rust, dirt, scale, grease and other deleterious matter and then primed with the highest grade zinc rich primer. After erection or installation, primed surfaces shall be properly cleaned of foreign or deleterious matter that might impair proper bonding of subsequent paint coatings. Abrasion or other damage to shop or field prime coat shall be properly repaired and touched up with same material used for original priming.

3. Where equipment is provided with nameplate data, the nameplate shall be masked off prior to painting. When painting is completed, remove masking material.

3.7 PIPING SYSTEMS INSTALLATION

A. At time of final connection, and prior to opening valve to allow pressurization of water piping from existing systems, on site or off site, perform a pressure test to indicate static pressure of existing systems. If pressure on fire protection piping is greater than 175 psi, inform Architect immediately. Do not allow piping systems to be pressurized without written consent of the Architect.

B. General:

1. Piping shall be concealed unless shown or otherwise directed. Allow sufficient space for ceiling panel removal.
2. Installation of piping shall be made with appropriate fittings. Bending of piping will not be accepted.
3. Install piping to permit application of insulation where required and to allow valve servicing.
4. Where piping or conduit is left exposed within a room, the piping or conduit shall be run true to vertical, horizontal, or intended planes. Where possible, uniform margins are to be maintained between parallel lines and/or adjacent wall, floor, or ceiling surfaces.
5. Horizontal runs of pipes and/or electrical conduit suspended from ceilings shall provide for maximum headroom clearance. The clearance shall not be less than 6'-6" without written approval from Architect.
6. Close ends of pipe immediately after installation. Leave closure in place until removal is necessary for completion of installation.
7. Each piping system shall be thoroughly flushed and proved clean before connection to equipment.
8. Install exposed polished or enameled connections with special care showing no tool marks or threads at fittings.
9. Install horizontal valves with valve stem above horizontal.
10. Use reducing fittings; bushings shall not be allowed. Use eccentric reducing fittings wherever necessary to provide free drainage of lines and passage of air.
11. Verify final equipment locations for roughing-in.
12. Where piping is installed in walls within one inch of face of stud, provide 16 gauge sheet metal shield plate on face of stud. The shield plate shall extend minimum 1-1/2 inches beyond outside diameter of pipe.

C. Expansion Loops:

1. Install expansion loops where piping crosses building expansion or seismic joints, between buildings, between buildings and canopies, and as indicated on Drawings.
2. Install expansion loops of sizes matching sizes of connected piping.
3. Install grooved-joint expansion joints to grooved-end steel piping.
4. Materials of construction and end fitting type shall be consistent with pipe material and type of gas or liquid conveyed by piping system in which expansion loop is installed.

D. Sleeves:

1. Install Adjus-to-Crete, Pipeline Seal and Insulator, or equal, pipe sleeves of sufficient size to allow for free motion of pipe, 24 gauge galvanized steel. The space between pipe and sleeves through floor slabs on ground, through outside walls above or below grade, through roof, and other locations, as directed, shall be caulked with oakum and mastic and made watertight. The space between pipe and sleeve and between sleeve and slab or wall shall be sealed watertight.
2. At Contractor's option, Link-Seal, Metraflex Metraseal, or equal, casing seals may be used in lieu of caulking. Wrap pipes through slabs on grade with 1 inch thick fiberglass insulation to completely isolate pipe from concrete.

E. Floor, Wall, and Ceiling Plates:

1. Fit pipes, with or without insulation, passing through walls, floors, or ceilings, and hanger rods penetrating finished ceilings with chrome-plated or stainless escutcheon plates.

F. Firestopping:

1. Pack annular space between pipe sleeves and pipe through floors and walls with UL listed fire stop, and seal at ends. Pipe penetrations shall be UL listed, Hilti, 3M Pro-Set, or equal.

    a. Install fire caulking behind fire protection services installed within fire rated walls, to maintain continuous rating of wall construction.

2. Provide SpecSeal Systems UL fire rated sleeve/coupling penetrators, or equal, for each pipe penetration or fixture opening passing through floors, walls, partitions or floor/ceiling assemblies. Penetrators shall comply with UL Fire Resistance Directory (Latest Edition), and with Chapter 7, CBC requirements.
3. Sleeve penetrators shall have built in anchor ring for waterproofing and anchoring into concrete pours or use special fit cored hole penetrator for cored holes.
4. Copper and steel piping shall have SpecSeal, or equal, plugs on both sides of penetrator to reduce noise and to provide waterproofing.
5. All above systems to be installed in strict accordance with manufacturer's instructions.
6. Alternate firestopping systems are acceptable if approved as equal. Contractor is responsible for determining suitability of alternate products for their intended use, and shall assume all risks and liabilities in connection with the use of alternate products.

G. Hangers and Supports:

1. General: Support equipment and piping so that it is firmly held in place by approved iron hangers and supports and special hangers as required. Hangers and supports shall be UL listed for fire protection service. Components shall support weight of equipment, pipe, fluid, and pipe insulation based on spacing between supports with minimum factor of safety of five based on ultimate strength of material used. Do not exceed manufacturer's load rating. Pipe attachments or hangers, shall be of same size as pipe or tubing on which used, or nearest size available. Architect shall approve hanger material before installation. Do not support piping with plumbers' tape, wire

rope, wood, or other makeshift devices. Where building structural members do not match piping support spacing, provide “trapeze” (bridging) support members attached to building structural members by methods approved by structural Engineer.

a. Materials, design, and type numbers per Manufacturers' Standardization Society (MSS), Standard Practice (SP)-58.

2. Hanger components shall be provided by one manufacturer. B-Line, Grinnell, Tolco, Afcon, Loos & Co., Uni-Strut, or equal.
3. Hanger and Supports:

a. Vertical Piping: Tolco Fig. 6, or equal, clamps attached to pipe above each floor to rest on floor. Provide intermediate support for vertical piping greater than 25 feet in length.
b. Individually Suspended Piping: Tolco Fig. 200 or Fig. 1 Clevis, complete with threaded rod, or equal.

Pipe Size	Rod Size
4" and Smaller	3/8"
5" to 6"	5/8"

c. Trapeze Suspension: Sch-10 or Sch-40 steel pipe trapeze member in accordance with NFPA 13 published load ratings.
d. Pipe Clamps and Straps: B-Line B2000 or B2400, Tolco, Fig. 200 or Fig. 1, or equal. Where used for seismic support systems, provide B-line B2400, Tolco fig. 69 series retainer pipe straps, or equal.
e. Deck Connectors: Afcon Fig. 610 steel ceiling plate, or equal, where approved by structural Engineer.

4. Support to Structure:

a. Wood Structure: Provide and install wood blocking as required to suit structure. Provide lag screws or through bolts with length to suit requirements, and with size (diameter) to match the size of hanger rods required.

1) Do not install Lag screws in tension without written review and acceptance by Structural Engineer.

Side Beam Angle Clip	B-Line B3062--MSS Type 34
Side Beam Angle Clip	B-Line B3060
Ceiling Flange	B-Line B3199

2) Blocking for support of piping shall be not less than 2 inch thick for piping up to 2 inch size. Provide 3 inch blocking for piping up through 5

inch size, and 4 inch blocking for larger piping. Provide support for blocking in accordance with Structural Engineers requirements.

3) Where lag screws are used, length of screw shall be 1/2 inch less than the wood blocking. Pre-drill starter holes for each lag screw.

5. Pipe hanger and support spacing: Locate hangers and supports at each change of direction, within one foot of elbow, and spaced per NFPA 13, and per pipe manufacturer's listing, except as noted below.
6. Provide rigid insulation and a 12 inch long, 18 gauge galvanized sheet iron shield between the covering and the hanger whenever hangers are installed on the outside of the pipe covering.
7. Insulate copper piping from ferrous materials and hangers with two layers of 3 inch wide, 10 mil polyvinyl tape wrapped around pipe.
8. Provide a support or hanger close to each change of direction of pipe either horizontal or vertical and as near as possible to concentrated loads.
9. Suspend rods from concrete inserts with removable nuts where suspended from concrete decks. Power actuated inserts will not be allowed.

3.8 UNION AND FLANGE INSTALLATION

A. Install Watts, Epco, Nibco, or equal, dielectric unions or flanges at points of connection between copper or brass piping or material and steel pipe or material. Bushings or couplings shall not be used.

B. Install unions in piping NPS 2” and smaller and flanges in piping NPS 2-1/2” and larger whether shown or not at each connection to equipment and tanks, and at connections to automatic valves.

C. Locate unions for easy removal of equipment, tanks, or valves.

3.9 ACCESS DOOR INSTALLATION

A. Furnish and install access doors wherever required whether shown or not for easy maintenance of fire protection systems. Access doors shall provide for complete removal and replacement of equipment.

3.10 CONCRETE WORK

A. Concrete work required for Work of this Section shall be included under another section of the Specification, unless otherwise noted, including reinforced concrete bases for pumps, tanks, compressors unless the work is specifically indicated on Drawings to be furnished under this Section.

B. Thrust blocks, underground anchors, and pads for cleanouts, valve access boxes and washer boxes are included under this Section of the Specifications. Concrete shall be 3000 psi test minimum. Refer to Division 03 for concrete types.

3.11 PIPE IDENTIFICATION

A. Provide temporary identification of each pipe installed, at time of installation. Temporary identification shall be removed and replaced with permanent identification as part of the Work.

B. Apply legend and flow arrow at valve locations; at points where piping enters or leaves a wall, partition, cluster of piping or similar obstruction, at each change of direction, and at approximately 20'-0" intervals on pipe runs. Variations or changes in locations and spacing may be made with approval of Architect. There shall be at least one marking in each room. Markings shall be located for maximum visibility from expected personnel approach.

1. Apply legend and flow arrow at approximately 10’-0” intervals in science classrooms and science prep rooms.

C. Wherever two or more pipes run parallel, markings shall be supplied in the same relative location on each.

D. Apply markings after painting and cleaning of piping and insulation is completed.

3.12 EXPANSION ANCHORS IN HARDENED CONCRETE:

A. Refer to Structural Drawings.

3.13 TESTS AND ADJUSTMENTS

A. Test installations in accordance with the following requirements and all applicable codes:

1. Project Inspector should witness tests of piping systems.
2. Notify Architect at least seven days in advance of tests.
3. Notify local fire department of time and date of fire systems testing.
4. Piping shall be tested at completion of roughing-in, or at other times as directed by Architect.
5. Furnish necessary materials, test pumps, gases, instruments and labor required for testing.
6. Isolate from system equipment that may be damaged by test pressure.
7. Make connections to existing systems with flanged connection. During testing of new work, provide a slip-in plate to restrict test pressure to new systems only. Remove plate and complete connection to existing system at completion of testing.

    a. Project Inspector shall witness final connection to system.

B. Test Schedule: No loss in pressure or visible leaks shall show after four hours at pressures indicated:

System Tested	Test Pressure PSI	Test With
Fire Sprinkler Piping	200	Water
Compressed Air	200	Air & Non-corrosive Leak Test Fluid
Dry Standpipes	300	Water
Wet Standpipes	200	Water

1. Piping, including underground piping, connected to fire sprinkler system shall be tested and certified in accordance with NFPA requirements, except where requirements listed in this Section exceed requirements of NFPA.
2. Non-corrosive leak test fluid shall be suitable for use with piping material specified, and with type of gas conveyed by piping system.

C. Should material or work fail in any of these tests, it shall be immediately removed and replaced with new material, and portion of work replaced shall again be tested by Contractor at his own expense.

D. Lubricate each item of equipment, including motors, before operation.

3.14 TRACER WIRE INSTALLATION

A. Provide tracer wire for non-metallic water pipe in ground outside of buildings. Use AWG #14 tracer wire with blue colored low density high molecular weight polyethylene insulation, and lay continuously on pipe so that it is not broken or stressed by backfilling operations. Secure wire to the piping with tape at 18 inch intervals. Solder all joints.

B. Terminals: Precast concrete box and cast iron locking traffic cover, Brooks 3TL, or equal; cover marked with name of service; 6 inches of loose gravel below box. Plastic terminal board with brass bolts; identify line direction with plastic tags. Test for continuity between terminals, after backfilling, in presence of Inspector.

C. Alternate: Use electronically detectable plastic tape with metallic core, Terra Tape D, manufactured by Reef Industries, Inc., Seton, Inc., Marking Services, Inc., or equal; tape 2 inches wide, continuously imprinted "CAUTION WATER LINE BELOW". Install, with printed side up, directly over pipe, 18 inches below finish grade. Backfill material shall be as previously specified for the particular condition where pipe is installed, but avoid use of crushed rock or of earth with particles larger than l/2 inch within the top 12 inches of backfill. Take precautions to ensure that tape is not damaged or misplaced during backfill operations. Terminal boxes not required.

3.15 CHECK, TEST AND START REQUIREMENTS

A. An authorized representative of the equipment manufacturer shall perform check, test and start of each piece of fire protection equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the check test and start of the equipment.

1. As part of the submittal process, provide a copy of each manufacturer's printed startup form to be used.
2. Some items of specified equipment may require that check, test and start of equipment must be performed by the manufacturer, using manufacturer's employees. See specific equipment Articles in these Specifications for this requirement.
3. Provide all personnel, test instruments, and equipment to properly perform the check, test and start work.
4. When work has been completed, provide copies of reports for review, prior to final observation of work.

B. Provide copies of the completed check, test and start report of each item of equipment, bound with the Operation and Maintenance Manual.

C. Upon completion of the work, provide a schedule of planned maintenance for each piece of equipment. Indicate frequency of service, recommended spare parts and methods for adjustment and alignment of all equipment components. Provide a copy of the schedule with each operating and maintenance manual. Provide a copy of certification from the Owner's representative indicating that they have been properly instructed in maintenance requirements for the equipment installed.

3.16 COMMISSIONING AND PRELIMINARY OPERATIONAL TESTS

A. Prior to observation to determine final acceptance, put fire protection systems into service and check that work required has been done, including but not limited to the following condensed check list. Provide indexed report to tabulating the results of tests.

1. Equipment has been started, checked, lubricated and adjusted in accordance with manufacturer's recommendations.
2. Correct rotation of motors and ratings of overload heaters are verified.
3. All manufacturers' certificates of start-up specified have been delivered to Owner.
4. All equipment has been cleaned, and damaged painted finishes touched up.
5. Missing or damaged parts have been replaced.
6. Flushing of piping systems has been completed and water treatment equipment, where specified, is completed.
7. Equipment labels, pipe marker labels, ceiling markers and valve tags are installed.
8. Valve tag schedules, corrected control diagrams, sequence of operation lists and start-stop instructions have been posted.
9. Maintenance manuals have been delivered and Owner training has been completed.

B. Review of Contractor's Tests:

1. Tests made by Contractor or manufacturers' representatives are subject to observation and review by Owner. Provide timely notice prior to start of each test, in order to allow for observation of testing. Upon completion of tests, provide letter to confirm that testing has been successful.

C. Test Logs:

1. Maintain test logs listing the tests on mechanical systems showing dates, items tested, inspectors' names, remarks on success or failure of tests.

END OF SECTION 21 00 50

SECTION 21 10 00 - FIRE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sprinkler heads.
2. Pipe and Fittings.
3. Valves.
4. Water flow alarm switch.
5. Fire Department connection.
6. Post indicator valve.
7. Antifreeze system.

1.2 RELATED REQUIREMENTS

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

B. Section 21 00 50 Basic Fire Sprinkler Materials and Methods.

1.3 REFERENCES AND STANDARDS

A. It is the intent of these Specifications to provide for complete and operating fire protection automatic sprinkler system in full compliance with the following standards:

1. National Fire Protection Association (NFPA) Standard No. 13, 2022, as amended by the CBC.
2. CBC Chapter 9.

B. The work shall also be in accordance with local or state requirements that apply.

1.4 DESCRIPTION OF WORK

A. Work of this section includes, but is not necessarily limited to, the following:

B. An existing fire sprinkler system is in place, consisting of a fire sprinkler riser for each zone with the main supply line and zone control valve for each floor, branch lines, and tees to each sprinkler head. Extend and modify the existing system as required to properly protect the building in accordance with NFPA 13 criteria.

C. Furnish all coordination, labor, materials, tools, and equipment to install a wet pipe automatic fire sprinkler system as described in this Specification Section, and shown on Contract Drawings.

1. The Work includes, but is not limited to the following:

a. Complete automatic fire risers, including valves, fire department connections, flow switches, pressure switch and service mains as indicated on Drawings.
b. Complete interior wet type automatic fire protection spray type sprinkler distribution system, including overhead service and branch mains, lateral supply piping, supports, hangers, seismic bracing, and heads, as indicated on Drawings.
c. Required tests and inspections.
d. Provide electrical work required to complete the system. Contractor shall be responsible for providing complete and operable systems, including electrical wiring. Install wiring in conduit, in accordance with Division 26.
e. Protected areas include areas above and below the finished ceilings, exterior exposure, canopies, stairways, rooms, areaways, entry, etc, and other areas requiring sprinklers.
f. Tags, identification labels and instruction manuals for proper operation and maintenance.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Sequencing:

1. It is expected that the Project shall progress according to the following sequence of events:

a. Upon award of bid, Contractor shall begin preparing coordination drawings. See Coordination Article.
b. Completed coordination drawings shall be submitted to Architect for review. See Submittals Article in this Section and in Section 21 00 50.
c. Engineer will determine need for Project re-submittal to DSA:

1) No DSA re-submittal required: Coordination drawings will be returned to Contractor with comments noted and Contractor shall proceed with fabrication and erection of system in accordance with Contract Documents and reviewed submittal.
2) DSA re-submittal required: Engineer will incorporate changes depicted in coordination drawings into Contract Drawings and hydraulic calculations for re-submittal to DSA. Upon DSA approval of re-submittal, Contractor shall proceed with fabrication and erection of system in accordance with modified Contract Documents.

d. Contractor shall issue Request for Information (RFI) for each field change required after approval of coordination drawings or approval of DSA re-submittal has been obtained. Contractor shall not proceed with changes prior to RFI response.

e. Contractor shall inform Architect immediately if deviating from this sequence of events.

2. The coordination process may not be used to redesign an automatic fire sprinkler system by the Contractor. Only those changes required for coordination with the work of other trades will be allowed.

B. Coordination:

1. Coordinate Work in this Section with trades covered in other Sections of Specifications to provide a complete and operable installation of highest quality workmanship.
2. Coordinate location of fire protection piping, mains and branches, to avoid interference with work by other trades. Plumbing drainage piping and ductwork shall have right-of-way over fire protection piping. Wherever conflicts exist, fire protection piping shall be offset or rerouted at no additional cost to Owner. Provide locations of piping for use in Coordinated Layout called for in Specification Section 23 80 00.
3. Piping shall be concealed, except where so indicated or where absolutely necessary to be exposed. Exposed piping shall be placed as approved by Architect prior to installation. Heads shall be fully coordinated with architectural reflected ceiling plan and placed in center of ceiling tiles.
4. On-site measurement of pipe will be required. Offsets, pipe, fittings, drains, etc., required to meet job conditions shall be furnished and installed at no extra cost to Owner.
5. Additional heads required by NFPA 13 regulations shall be provided at no extra cost, if required as a result of Contractors' coordination. Location of heads and mains shall not be changed unless approved by Architect.
6. Coordinate layout and installation of sprinklers with other construction penetrating ceilings, including light fixtures, HVAC equipment, and partition assemblies.
7. The Architect shall decide any differences or disputes concerning coordination, interference or extent of work, and his decision shall be final.
8. Contract Drawings are schematic. Rerouting of pipe and the addition, deletion or relocation of sprinkler heads may be necessary. Contractor shall prepare coordination drawings documenting changes. Contractor shall not proceed with fabrication or installation of fire protection system prior to approval of coordination drawings by Architect.

    a. Re-submittal of revised Contract Drawings and calculations to DSA will be required when changes to the system design, made during Project coordination phase, alter parameters used in calculations furnished to DSA for permitting purposes. If re-submittal to DSA is required, mechanical Engineer shall prepare revised Drawings and hydraulic calculations. Contractor shall not proceed with fabrication or installation of fire protection system prior to approval of revised calculations by DSA.
    b. Contractor-proposed changes to supports, anchorages, and seismic restraints for fire protection system shall conform to the following.

        1) Calculations performed for use in selection of supports, anchorages, and seismic restraints shall utilize criteria indicated in Structural Contract Documents.

2) Supports, anchorage and seismic restraints for piping and equipment shall be an HCAI pre-approved system such as Tolco, Afcon, ISAT, Badger, Mason, or equal. Pipes and equipment shall be seismically restrained in accordance with requirements of current editions of California Building Code and NFPA 13. System shall have current OPM number and shall meet additional requirements of authority having jurisdiction. Provide supporting documentation required by the reviewing authority and the Architect and Engineer. Provide layout drawings showing piping and restraint locations.

   a) Bracing of Piping and Equipment: Specifically state how bracing attachment to structure is accomplished. Provide shop drawings indicating seismic restraints, including details of anchorage to building. In-line equipment must be braced independently of piping, and in conformance with applicable building codes. Provide calculations to show that pre-approval numbers have been correctly applied in accordance with general information notes of pre-approval documentation.

3) In lieu of the above or for non-standard installations not covered in the above pre-approved systems, Contractor shall provide layout drawings showing piping, equipment, and restraint locations, and detailing supports, attachments and restraints. Furnish supporting calculations and legible details sealed by a California registered structural engineer, in accordance with California Building Code, and NFPA 13.
4) Additional Requirements: In addition to the above, conform to State and local requirements.

1.6 DRAWINGS

A. Contractor shall thoroughly examine architectural, structural, and other Drawings provided as part of this Contract.

B. Number of sprinkler heads indicated on Contract Drawings shall not be reduced. Provide additional heads required for coordination and to obtain approvals. Coordinate suitable head locations and spacing with Architect.

C. Installation Criteria: Provide complete fire protection systems as indicated and as required by authority having jurisdiction.

1. When there is conflict between requirements of authority having jurisdiction or requirements of other agencies and these Drawings and Specifications, requirements of authority having jurisdiction and recommendations of standards agencies shall govern.
2. Install entire system in accord with applicable codes, standards, and regulations.
3. The automatic sprinkler system shall conform to requirements of the National Fire Protection Association, Standard No. 13, as amended by the CBC.
4. FM Compliance: Comply with Factory Mutual “Approval Guide.”

5. Supply equipment and accessories in accordance with requirements of applicable national, state and local codes.
6. Items of a given type shall be the products of the same manufacturer.
7. Scheduled equipment performance is minimum capacity required.
8. Scheduled electrical capacity shall be considered as maximum available.

1.7 ACTION SUBMITTALS

A. For additional requirements, refer to Section 21 00 50, Basic Fire Sprinkler Materials and Methods.

B. Product Data: Submit manufacturer's technical product data and installation instructions for fire protection systems materials and products.

C. Samples: Provide one sample of each sprinkler head type.

1.8 INFORMATIONAL SUBMITTALS

A. For additional requirements, refer to Section 21 00 50, Basic Fire Sprinkler Materials and Methods.

B. Welding operator qualification certificates.

C. Office of the State Fire Marshall (OSFM) certification cards for automatic fire extinguishing systems sprinkler pipefitters.

D. Coordination Drawings: Submit in accordance with Division 01, and as follows:

1. Provide minimum 1/4 inch equals one foot scaled coordination drawings showing plan and pertinent section or elevation views of fire protection piping, equipment, and accessories. Drawings shall be reproducible and work represented shall be fully coordinated with structure, other disciplines, and with finishes. Drawings shall be presented on a single size sheet. Coordination drawings shall have title block, key plan, north arrow and sufficient grid lines to provide cross-reference to DSA approved Drawings.
2. Coordination drawings shall depict changes and additions to fire protection system required for coordination with work of other trades. Changes and additions shall be clouded.
3. Note on coordination drawings piping which will project beyond finished surfaces of normally occupied rooms, exterior of building or other locations which will expose system to view.
4. Coordination drawings shall be provided with note affirming that the fire sprinkler system shown has been coordinated with the HVAC Contractor for inclusion in Coordinated Layout specified in Section 23 80 00. Provide signature of person responsible for information supplied and date of transmission.

E. For proposed changes to supports, anchorage, and seismic restraints shown on DSA approved Contract Drawings, submit details and calculations prepared, sealed, and signed by

a California registered structural engineer. Comply with requirements of Coordination Article in this Section.

F. Test Reports: As indicated in paragraph “Tests.”

1. Sprinkler pressure test.
2. Standpipe pressure test.
3. Alarm system test.
4. Underground piping test.

1.9 CLOSEOUT SUBMITTALS

A. For additional requirements, refer to Section 21 00 50, Basic Fire Sprinkler Materials and Methods.

B. Operation and Maintenance Manual:

1. Operation and Maintenance Manual in accordance with Section 21 00 50. Include an original copy of NFPA 25, California edition, in Operation and Maintenance Manual for fire sprinkler system.
2. Guarantees in accordance with Division 01.

1.10 TEMPORARY CONNECTIONS

A. Temporary connections required to maintain services during the course of the Contract shall be made without additional cost to Owner. The normal function of the building must not be interrupted; notify Owner minimum seven days in advance before interrupting any service.

1.11 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of fire protection products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer Qualifications: A firm with at least five years of successful installation experience on projects with fire sprinkler piping systems similar to that required for this Project.

1. A State of California Fire Protection Contractor’s license (C-16) is required.

C. Fire Sprinkler Fitter Certification:

1. Automatic fire extinguishing systems sprinkler pipefitters shall be certified by Office of the State Fire Marshall (OSFM).

PART 2 - PRODUCTS

2.1 GENERAL

A. The equipment to be furnished under this Specification shall be standard product of manufacturer. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer; however, component parts of system need not be products of the same manufacturer.

2.2 MATERIALS AND EQUIPMENT

A. Unless otherwise shown on Drawings, specified, or directed by Architect, materials and equipment used in installation of sprinkler systems shall be listed as approved by FM or UL for fire protection systems, and shall be the latest design of the manufacturer.

2.3 SPRINKLER HEADS

A. Provide spray pattern type sprinkler heads, of ordinary degree temperature rating, except that sprinkler heads for installation in vicinity of heating equipment, and in other areas noted on Drawings, shall have temperature ratings required for such locations by NFPA 13.

B. Sprinkler heads shall be upright, pendent or sidewall, as required.

1. Heads in ceilings of occupied spaces with recessed lights shall be chrome plated, semi-recessed pendent type, with white escutcheon.
2. Sprinkler heads in rooms with surface mounted lights shall be chrome plated pendant style, with two-piece white escutcheon.
3. Provide head guards in equipment rooms and storage rooms and all other locations where subject to damage.
4. Upright heads in areas with no ceilings shall be rough bronze finish.
5. Provide quick response type heads in light and ordinary hazard occupancies.
6. Side wall heads may be used (except in extended coverage type) to cover special areas where overhead piping and heads are impractical or considered a visual problem by the Architect or Owner. Side wall heads shall be chrome finish.
7. Outdoor heads, if required shall be dry or freeze resistant.
8. Adjustable drop nipples are not acceptable.

C. Recessed sprinkler heads shall have chrome finish and adjustable chrome finish escutcheons; exposed pendent heads in finished ceilings shall have chrome finish and white ceiling escutcheons. Concealed (flush) heads shall be all brass, with white cover plate.

1. Provide oversized escutcheons where required to meet the requirements of ASCE 7.

D. Spare Heads: Furnish spare heads equal to one percent of total number of heads installed under Contract, but not less than twelve. Spare head types furnished shall be representative of types and temperature ratings of heads installed, and in proportion to number of each type and temperature rating of heads installed. Furnish not less than two sprinkler head wrenches,

with at least one wrench for each type of sprinkler head installed. Place spare heads and wrenches in wall mounted box manufactured for this purpose.

2.4 PIPE AND FITTINGS

A. For Installation Aboveground: Schedule 40 black steel pipe, ASTM A 53 with ductile or cast iron screwed fittings.

1. Schedule 10 black steel pipe, ASTM A 135 or ASTM A 795, with grooved fittings and associated couplings may be used for pipe sizes 2 inches through 5 inches. Provide NFPA 13-specified wall thickness for pipe sizes 6 inches through 10 inches. Threading of piping will not be accepted.

B. For Installation Underground to 12 inches Above Ground:

1. Pipe and fittings shall be approved for fire protection use.
2. Underground Piping Outside Building: PVC Pipe: AWWA C900 or UL 1285, Class 200, with bell end with gasket, and with spigot end. PVC Fittings: AWWA C900 or UL 1285, Class 200, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

        1) Diamond Plastics Corporation.
        2) J.M. Eagle, Inc.

3. Underground Piping Below Building Footing and Slab: One-piece, 304 stainless steel 90-degree fitting, with AWWA C900 bell-and-spigot gasketed inlet connection with lugs on inlet end, and AWWA C606 groove on outlet end, for connection to in-building riser using AWWA C606 grooved couplers and gaskets.

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

        1) Ames Fire and Waterworks, a Watts Water Technologies Company.
        2) Wilkins, a Zurn Company.

C. Standpipes: Schedule 40 galvanized steel with 300 psi galvanized fittings.

D. Mechanical tees, saddle fittings, bushings and mechanical sprinkler head fittings shall not be used.

2.5 VALVES

A. Angle, Check, and Globe Valves: Fed. Spec WW-V-51; Class A, type as suitable for application.

1. Select check valves for installation in vertical lines recommended by manufacturer as suitable for vertical installation. Install in vertical lines only where flow is upward.

B. Gate Valves:

1. Sizes 1-1/2 inches or less: Fed. Spec WW-V-54, Class A.
2. Sizes above 1-1/2 inches: Fed. Spec WW-V-58, Class A, designation OS or OF, as required. Provide OS&Y type, 175 pound rated working pressure.
3. Furnish and deliver to Owner one wrench of each size required for operating underground valves.

C. Drain Valves: angle, or globe. Fed. Spec WW-V-51; Class A, type as suitable for application.

1. UL listed and FM approved combination test and drain fittings may be used.

D. Zone Control Valves: UL listed, outside screw and yoke or butterfly. Valves shall be sealed open with approved seal. Provide weatherproof actuator housing, with two single pole, double throw switches.

1. Supervisory Switch: Fit the control valves on the fire sprinkler risers with supervisory switch, with single pole double throw switch actuator installed to change switch position when valve is being closed.

E. Sprinkler Inspector's Test Fittings:

1. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
2. Pressure Rating: 175-psig minimum.
3. Body Material: Cast- or ductile-iron housing with sight glass.
4. Integral factory or field-installed pressure relief valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

2.6 WATER FLOW ALARM SWITCH

A. UL listed water flow alarm switch suitable for variable pressure, complete with instantaneous recycling retard and two single pole double throw electrical contacts. Provide continuously monitored water flow alarm switch and trouble sensor, automatically transmitted to an approved control alarm station.

2.7 FIRE DEPARTMENT CONNECTION

A. Post mounted, complying with Local Fire Marshal standards cast brass two-way inlet body with drop clappers. Furnish with two brass double female snoots with rigid end N.P.T.X. pin lug house thread swivels, plugs and chain.

B. Provide check valve in piping between inlet connection and fire protection system. Provide ball drip at low point of piping, below grade on the inlet side of the check valve, and drain to gravel sump. Provide gravel sump with minimum 3 cubic feet of course gravel.

2.8 POST INDICATOR VALVE

A. Mueller, American Cast Iron Pipe Co., or equal, UL-listed; provide handle lock and water flow alarm switch.

2.9 ANTIFREEZE SYSTEMS

A. Provide antifreeze systems where shown on Contract Drawings.

B. Antifreeze systems shall be installed, labeled, and tested in accordance with NFPA 13.

C. Where solution based antifreeze systems are installed, Contractor shall provide antifreeze solution with a freezing point of minus 26 degrees F. or lower. Provide antifreeze test kit and adequate instructions for testing concentration and freeze point.

2.10 UNION AND FLANGES

A. Size and Type:

1. Steel 2 inches and smaller: 150 pound screwed black or galvanized malleable iron, match pipe, ground joint, brass to iron seat.
2. Steel 2-1/2 inches and larger: 150 pound black flange union, flat faced, full gasket.

B. Gaskets: 1/16 inch thick rubber Garlock #122, Johns-Manville, or equal.

C. Flange Bolts: Open hearth bolt steel, square heads, with cold pressed hexagonal nuts, cadmium plated when installed below ground. Provide copper plated steel bolts and nuts or brass bolts and nuts for brass flanges.

2.11 GAUGES

A. Marsh "Quality Gage", U.S. Gage, Danton 800, or equal, U.L. listed, with bronze bushed movement and front recalibration. Dials shall be white with black numerals, 3-1/2 inch dial face. Normal reading shall be at midscale. Provide a three-way valve on each gauge connection.

2.12 SEISMIC SEPARATION ASSEMBLY

A. Provide seismic separation assembly as defined in NFPA 13 at locations where piping crosses building seismic joints and at locations where required to prevent pipe breakage due to building movement.

1. At Contractors option, provide Metraflex “Fireloop” UL listed assembly, or equal at each seismic joint location, in lieu of seismic separation assembly.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation of the sprinkler system shall not be started until complete plans and specifications (including water supply information and type of existing sprinkler system, if any) have been approved by DSA.

1. Piping shall be concealed unless shown or otherwise directed.
2. Where piping is left exposed within a room, it shall be run true to vertical, horizontal or intended planes. Where possible, uniform margins shall be maintained between parallel lines and/or adjacent wall, floor or ceiling surfaces.
3. Horizontal runs of pipes and/or electrical conduit suspended from ceilings shall provide for maximum headroom clearance. This clearance shall not be less than 6'-6" without written approval from Architect.
4. Minor changes in locations of equipment, piping, etc., from locations shown shall be made when directed by Architect at no additional cost to Owner, providing such change is ordered before such items of work, or work directly connected to same, are installed, and providing no additional material is required.
5. Grade all piping as required by NFPA 13.
6. Close ends of pipe immediately after installation; leave closure in place until removal is necessary for completion of installation.
7. Piping systems shall be thoroughly flushed and proved clean before connection to equipment.
8. Pipe discharge of each drain valve to floor sink or drain.

3.2 HANGER AND SUPPORT INSTALLATION

A. General: Support piping so that it is firmly held in place by approved iron hangers and supports and by special hangers as required in accordance with NFPA 13. Hangers shall support loads specified in NFPA 13, and, in addition, shall support weight of pipe, fluid and pipe insulation, based on spacing between supports with minimum factor of safety of five based on ultimate strength of material used. Do not exceed manufacturer's load rating. Pipe attachments, or hangers, shall be of same size as pipe or tubing on which used, or nearest larger size available. Materials, design, and type numbers per Manufacturers' Standardization Society (MSS) Standard Practice SP-58, provide branch line restraints where hangers exceed 6 inches long, in accordance with NFPA 13. Install concrete anchors required. Hanger

material shall be approved by Architect before installation. Do not support piping by plumbers' tape, wire, rope, wood or other makeshift devices.

B. Suspend rods from angle clips, in accordance with Section 21 00 50.

3.3 SEISMIC REQUIREMENTS

A. Comply with CBC, Volume 2, Chapter 16A and CBC Chapter 9 and NFPA 13.

B. Items of equipment shown or specified to be anchored shall maintain integrity at point of anchor after being subjected to accelerations equivalent to those established herein

C. Anchors: Piping shall be provided with anchors for protection of piping against damage due to earthquakes, as required by CBC Chapter 16A, NFPA 13, and other sections of this Specification.

3.4 TESTS

A. At various stages and upon completion, the system shall be tested in the presence of the enforcing agency.

B. Upon completion and prior to acceptance of the installation, subject entire new system to tests required by NFPA 13, and furnish Owner with certificates as appropriate.

3.5 IDENTIFICATION

A. Coordinate requirements with the authority having jurisdiction.

B. Provide brass valve tags at each system valve, indicating valve service.

C. Provide signage at each sprinkler valve, with sign indicating specific portion of system controlled by valve.

D. Provide signage at each outdoor alarm device, with sign indicating which authority to call if device is activated.

E. Prior to final acceptance, Contractor shall provide accurate color-coded Building Plan at riser location, clearly depicting fire protection system area of coverage, location of inspectors’ test/drain connection and auxiliary drain connections. Provide this information at each system or building at riser location for building. Plan(s) shall be one-half size and plastic laminated.

F. Provide hydraulic data signage permanently attached to risers, indicating location, basis of design, water supply and pressure requirements of system.

3.6 ELECTRICAL WIRING

A. Coordination of wiring systems is part of this work. Contractor shall ensure that the following is completed.

1. Work provided in other Specification Sections:

   a. Supervised wiring to fire alarm control panel.
   b. Supervised wiring from main waterflow indicator to fire alarm panel.
   c. Supervised wiring from sprinkler flow switches to fire alarm panel.
   d. Supervised wiring from valve water flow alarm switches to fire alarm panel.

2. Work provided in this Specification Section:

   a. Wiring diagrams for devices.
   b. Other wiring not specified to provide an operating system.

3.7 SPRINKLER HEAD INSTALLATION

A. Heads shall be placed upright where on exposed piping, unless otherwise noted, and in pendant position on concealed piping, unless noted otherwise, with deflectors parallel to the ceiling or roof slope. Clearance between deflectors and ceilings, electric, or heating equipment, or other obstruction shall be in accordance with the requirements of NFPA 13. Provide sprinkler head guards where heads are subject to mechanical damage, for example, at mechanical rooms, and storage rooms and gymnasiums.

B. Mount box containing spare sprinkler heads and wrenches on wall in location selected by Owner.

C. Do not install pendent sprinkler heads until flushing of piping has been completed.

D. Provide return bend as illustrated in NFPA 13 (NFPA exceptions do not apply) for each sprinkler head installed in finished ceiling.

3.8 PIPING INSTALLATION

A. Pipe shall be assembled in accordance with the applicable requirements of NFPA 13 and NFPA 24.

B. Provide concrete thrust blocks for underground and underslab piping in accordance with NFPA 24 and CBC.

3.9 VALVE IDENTIFICATION

A. All valves shall be identified by permanent metal tags or other approved means.

3.10 DRAIN INSTALLATION

A. Auxiliary drains shall be installed on low points in each system.

1. Five or fewer trapped gallons will not require a drain valve but may be drained through a plugged fitting. Drain valves shall be in accordance with requirements of NFPA 13.

B. Install one inspector's test drain on sprinkler system. Extend drain to outside in location approved by Architect. Water discharge shall be positioned such that landscaping will not be damaged.

C. Drain valves shall be piped to a safe place of discharge and discharge shall be visible either by open-end drainpipe or sight drain fitting.

D. Provide flushing connections at ends of cross-mains.

3.11 SLEEVE INSTALLATION

A. Install AMI Products, Adjus-to-Crete, or equal, pipe sleeves of sufficient size to allow for free motion of pipe, 24 gauge galvanized steel. The space between pipe and sleeves through floor slabs on ground, through outside walls above or below grade, through roof, and other locations as directed shall be caulked with oakum and mastic and made watertight. The space between pipe and sleeve and between sleeve and slab or wall shall be sealed watertight.

B. Holes through existing concrete walls or floors shall be core drilled. The space between pipe and hole through floor slabs on ground, through outside walls above or below grade, through roof and other locations as directed shall be made watertight.

C. At walls below grade: Link-Seal casing seals, or equal, may be used in lieu of caulking. Pipes penetrating walls below grade shall be anchored at wall.

3.12 FLOOR, WALL, AND CEILING PLATE INSTALLATION

A. Fit pipes with or without insulation passing through walls, floors, or ceilings, and hanger rods penetrating finished ceilings with chrome plated or stainless steel plates.

3.13 FIRESTOPPING

A. The annular space between pipe sleeves and pipe passing through all floors and walls shall be packed with incombustible mastic or other suitable material, in accordance with U.L. Fire Resistance Directory.

B. Penetrations in fire rated assemblies shall also be protected in accordance with CBC Chapter 7, Section 712, and UL Fire Resistance Directory.

3.14 UNION AND FLANGE INSTALLATION

A. Install unions whether shown or not at each connection to equipment and at one connection to each valve or cock.

B. Locate the unions for easy removal of the equipment or valve.

3.15 CLEANING

A. Upon completion of tests, clean equipment, piping, etc., installed under this Section of the Specifications.

3.16 PIPING SYSTEM FLUSHING

A. Entire system shall be flushed out and cleaned after completion of piping, and prior to installation of sprinkler heads. Flush shall be continued until water runs clear at drain connections.

3.17 ANTIFREEZE SYSTEM INSTALLATION

A. Install antifreeze systems at the following locations and as noted on Drawings.

1. Location: where required to meet NFPA 13, and/or Part 2 Paragraph (above) titled “ANTI FREEZE SYSTEMS”.

B. Install antifreeze loops in accessible areas, and provide adequate signs providing instructions on maintenance of the system. Obtain approval of antifreeze loop location from Architect prior to any construction work.

END OF SECTION 21 10 00

SECTION 22 00 50 - BASIC PLUMBING MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Gauges.
2. Thermometers.
3. Access Doors.
4. Flexible joints.
5. Insulation.

1.2 RELATED REQUIREMENTS

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

B. This Section is a part of each Division 22 Section.

1.3 ADDITIONAL REQUIREMENTS

A. Furnish and install any incidental work not shown or specified which is necessary to provide a complete and workable system.

B. Make all temporary connections required to maintain services during the course of this Contract without additional cost to the Owner. Notify the Owner seven days in advance before disturbing any service.

C. Plumbing work done under this contract shall not adversely affect the operation of the existing plumbing systems.

1.4 REFERENCES AND STANDARDS

A. Where material or equipment is specified to conform to referenced standards, it shall be assumed that the most recent edition of the standard in effect at the time of bid shall be used.

1. CSA – Canadian Standards Association International.
2. ANSI - American National Standards Institute.
3. ASTM - American Society for Testing and Materials.
4. CCR - California Code of Regulations.

a. Title 8 - Division of Industrial Safety, Subchapter 7; General Industry Safety Orders, Articles 31 through 36.

5. NCPWB - National Certified Pipe Welding Bureau.
6. CEC - California Electrical Code.
7. NEMA - National Electrical Manufacturers' Association.
8. NFPA - National Fire Protection Association.
9. OSHA - Occupational Safety and Health Act.
10. UL - Underwriters' Laboratories, Inc.

B. Requirements of Regulatory Agencies:

1. The publications listed below form part of this specification; comply with provisions of these publications except as otherwise shown or specified.

a. California Building Code, 2022.
b. California Electrical Code, 2022.
c. California Energy Code, 2022.
d. California Fire Code, 2022.
e. California Green Building Standards Code, 2022.
f. California Mechanical Code, 2022.
g. California Plumbing Code, 2022.
h. California Code of Regulations, Title 24.
i. California Health and Safety Code.
j. CAL-OSHA.
k. California State Fire Marshal, Title 19 CCR.
l. National Fire Protection Association.
m. Occupational Safety and Health Administration.
n. Other applicable state laws.

2. Nothing in Drawings or specifications shall be construed to permit work not conforming to these codes, or to requirements of authorities having jurisdiction. It is not the intent of Drawings or specifications to repeat requirements of codes except where necessary for clarity.

1.5 DRAWINGS

A. Examine Contract Documents prior to bidding of work and report discrepancies in writing to Architect.

B. Drawings showing location of equipment and materials are diagrammatic and job conditions will not always permit installation in location shown. The Plumbing Drawings show general arrangement of equipment and materials, etc., and shall be followed as closely as existing conditions, actual building construction, and work of other trades permit.

1. Architectural and Structural Drawings shall be considered part of the Work. These Drawings furnish Contractor with information relating to design and construction of the Project. Architectural Drawings take precedence over Plumbing Drawings.
2. Because of the small scale of Plumbing Drawings, not all offsets, fittings, and accessories required are shown. Investigate structural and finish conditions affecting the Work and arrange Work accordingly. Provide offsets, fittings, and accessories required to meet conditions. Inform Architect immediately when job conditions do not

permit installation of equipment and materials in the locations shown. Obtain the Architects approval prior to relocation of equipment and materials.

3. Relocate equipment and materials installed without prior approval of the Architect. Remove and relocate equipment and materials at Contactors' expense upon Architects' direction.
4. Minor changes in locations of equipment, piping, etc., from locations shown shall be made when directed by the Architect at no additional cost to the Owner providing such change is ordered before such items of work, or work directly connected to same are installed and providing no additional material is required.

C. Execute work mentioned in Specifications and not shown on Drawings, or vice versa, the same as if specifically mentioned or shown in both.

1.6 FEES AND PERMITS

A. Obtain and pay for all permits and service required in installation of this work; arrange for required inspections and secure approvals from authorities having jurisdiction. Comply with requirements of Division 01.

B. Arrange for utility connections and pay charges incurred, including excess service charges.

1. Bear the cost of construction related to utility services, from point of connection to utility services shown on Contract Documents. This includes piping, excavation, backfill, meters, boxes, check valves, backflow prevention devices, general service valves, concrete work, and the like, whether or not Work is performed by Contractor, local water/sanitation district, public utility, other governmental agencies or agencies' assigns.

C. Coordination:

1. General:

a. Coordinate plumbing Work with trades covered in other Specifications Sections to provide a complete, operable and sanitary installation of the highest quality workmanship.

2. Electrical Coordination:

a. Refer to the Electrical Drawings and Specifications, Division 26, for service voltage and power feed wiring for equipment specified under this section. Contractor has full responsibility for the following items of work:

1) Review the Electrical Drawings and Division 26 Specifications to verify that electrical services provided are adequate and compatible with equipment requirements.
2) If additional electrical services are required above that indicated on Electrical Drawings and in Division 26, such as more control interlock conductors, larger feeder, or separate 120 volt control power source,

include cost to furnish and install additional electrical services as part of the bid.

3) Prior to proceeding with installation of additional electrical work, submit detailed drawings indicating exact scope of additional electrical work.

3. Mechanical Coordination:

a. Arrange for pipe spaces, chases, slots and openings in building structure during progress of construction, to accommodate mechanical system installation.
b. Coordinate installation of supporting devices. Set sleeves in poured-in-place concrete and other structural components during progress of construction.
c. Coordinate requirements for access panels and doors for mechanical items requiring access where concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section “Access Doors and Frames.”
d. Coordinate with other trades equipment locations, pipe, duct and conduit runs, electrical outlets and fixtures, air inlets and outlets, and structural and architectural features. Provide information on location of piping and seismic bracing to other trades as required for a completely coordinated project.

1.7 SUBMITTALS - GENERAL

A. Refer to Division 01 Submittals Section(s) for additional requirements.

B. Submittal packages may be submitted via email as PDF electronic files, or as printed packages. PDFs shall be legible at actual size (100 percent). Provide seven copies of printed submittal packages.

C. Provide submittal of materials proposed for use as part of this Project. Product names in Specifications and on Drawings are used as standards of quality. Furnish standard items on specified equipment at no extra cost to the Contract regardless of disposition of submittal data. Other materials or methods shall not be used unless approved in writing by Architect. Architect's review will be required even though "or equal" or synonymous terms are used.

1. Partial or incomplete submittals will not be considered.
2. Quantities are Contractor's responsibility and will not be reviewed.
3. Provide materials of the same brand or manufacturer for each class of equipment or material.
4. Identify each item by manufacturer, brand, trade name, number, size, rating, or other data necessary to properly identify and review materials and equipment. Words "as specified" are not sufficient identification.
5. Identify each submittal item by reference to items’ Specification Section number and paragraph, by Drawing and detail number, and by unit tag number.
6. Organize submittals in same sequence as in Specification Sections.
7. Show physical arrangement, construction details, finishes, materials used in fabrications, provisions for piping entrance, access requirements for installation and maintenance, physical size, mechanical characteristics, foundation and support details, and weight.

a. Submit Shop Drawings, performance curves, and other pertinent data, showing size and capacity of proposed materials.
b. Specifically indicate, by drawn detail or note, that equipment complies with each specifically stated requirement of Contract Documents.
c. Drawings shall be drawn to scale and dimensioned (except schematic diagrams). Drawings may be prepared by vendor but must be submitted as instruments of Contractor, thoroughly checked and signed by Contractor before submission to Architect for review.
d. Catalog cuts and published material may be included with supplemental scaled drawings.

D. Review of submittals will be only for general conformance with design concept and general compliance with information given in Contract Documents. Review will not include quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with work of other trades, or construction safety precautions, which are sole responsibility of Contractor. Review of a component of an assembly does not indicate acceptance of an assembly. Deviations from Contract Documents not clearly identified by Contractor are Contractor's responsibility and will not be reviewed by Architect.

E. Within reasonable time after award of contract and in ample time to avoid delay of construction, submit to Architect Shop Drawings or submittals on all items of equipment and materials provided. Provide submittal in at least seven copies and in complete package.

1. Shop Drawings and submittals shall include Specification Section, Paragraph number, and Drawing unit symbol or detail number for reference. Organize submittals into booklets for each Specification section and submit in loose-leaf binders with index. Deviations from the Contract Documents shall be prominently displayed in the front of the submittal package and referenced to the applicable Contract requirement.

F. Furnish to the Project Inspector complete installation instructions on material and equipment before starting installation.

1.8 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for plumbing systems materials and products.

B. Shop Drawings.

C. Sustainable Design Submittals:

1. Product Data: For adhesives and sealants, documentation of compliance including printed statement of VOC content and chemical components.
2. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.

D. Pipe, pipe or plumbing fittings, fixtures, solder and flux installed in a system providing water for human consumption shall comply with lead free requirements of the California Health and Safety Code Section 11 68 75. Provide submittal information for products third-party

certified by an approved laboratory as complying with California Health and Safety Code Section 11 68 75.

1.9 INFORMATIONAL SUBMITTALS

A. Provide layouts for plumbing systems, for inclusion in coordinated layout specified in Section 23 80 00. Comply with requirements for layouts specified in Section 23 80 00.

1.10 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Refer to Division 01 for complete instructions.
2. Furnish three complete sets of Operation and Maintenance Manual bound in hardboard binder, and one compact disc containing complete Operation and Maintenance Manual in searchable PDF format. Provide Table of Contents. Provide index tabs for each piece of equipment in binder and disc. Begin compiling data upon approval of submittals.

a. Sets shall incorporate the following:

1) Product Data.
2) Shop Drawings.
3) Record Drawings.
4) Service telephone number, address and contact person for each category of equipment or system.
5) Complete operating and maintenance instructions for each item of plumbing equipment and systems.
6) Copies of guarantees/warrantees for each item of equipment and systems.
7) Test data and system balancing reports.
8) Typewritten maintenance instructions for each item of equipment listing lubricants to be used, frequency of lubrication, inspections required, adjustment, etc.
9) Manufacturers' bulletins with parts numbers, instructions, etc., for each item of equipment.
10) Control diagrams and literature.
11) A complete list or schedule of all scheduled valves giving the number of the valve, location and the rooms or area controlled by the valve. Identify each valve with a permanently attached metal tag stamped with number to match schedule. Post list in frame under plastic on wall in mechanical room or where directed by Architect.
12) Check test and start reports for each piece of plumbing equipment provided as part of the Work.
13) Commissioning and Preliminary Operation Tests required as part of the Work.

b. Post service telephone numbers and/or addresses in an appropriate place as designated by the Architect.

B. Record Drawings:

1. Refer to Division 01, Record Documents, for requirements governing Work specified herein.
2. Upon completion of the work, deliver to Architect the following:

a. Originals of drawings showing the Work exactly as installed.
b. One complete set of reproducible drawings showing the Work exactly as installed.
c. One compact disc with complete set of drawings in PDF format showing the Work exactly as installed.
d. Provide Contractor's signature, verifying accuracy of record drawings.
e. Obtain the signature of the Project Inspector for all record drawings.

1.11 SUBSTITUTIONS

A. Refer to Division 01 for complete instructions. Requirements given below are in addition to or are intended to amplify Division 01 requirements. In the case of conflict between requirements given herein and those of Division 01, Division 01 requirements shall apply.

B. It is the responsibility of Contractor to assume costs incurred because of additional work and or changes required to incorporate proposed substitute into the Project. Refer to Division 01 for complete instructions.

C. Substitutions will be interpreted to be all manufacturers other than those specifically listed in the Contract Documents by brand name, model or catalog number.

D. Only one request for substitution will be considered for each item of equipment or material.

E. Substitution requests shall include the following:

1. Reason for substitution request.
2. Complete submittal information as described herein; see "Submittals."
3. Coordinated scale layout drawings depicting position of substituted equipment in relation to other work, with required clearances for operation, maintenance and replacement.
4. List optional features required for substituted equipment to meet functional requirements of the system as indicated in Contract Documents.
5. Explanation of impact on connected utilities.
6. Explanation of impact on structural supports.

F. Installation of reviewed substitution is the Contractors' responsibility. Any mechanical, electrical, structural, or other changes required for installation of reviewed substituted equipment or material must be made by the Contractor without additional cost to the Owner. Review by the Architect of the substituted equipment or material, including dimensioned Drawings will not waive these requirements.

G. Contractor may be required to compensate the Architect for costs related to substituted equipment or material.

1.12 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing systems products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Contractor's Qualifications: Firm with at least 5 years of successful installation experience on projects with plumbing systems work similar to that required for this Project.

C. California Health and Safety Code Compliance: For products covered under the scope of HSC 116875 for potable water service. Products for potable water service shall be third-party certified by an approved laboratory as complying with California Health and Safety Code Section 11 68 75.

D. Comply with applicable portions of California Plumbing Code pertaining to selection and installation of plumbing materials and products.

E. All materials and products shall be new and shall match existing.

1.13 DELIVERY, STORAGE, AND HANDLING

A. Protect equipment and piping delivered to Project site from weather, humidity and temperature variations, dirt, dust and other contaminants.

1.14 FIELD CONDITIONS

A. Contractor shall visit Project site and examine existing conditions in order to become familiar with Project scope. Verify dimensions shown on Drawings at Project site. Bring discrepancies to the attention of Architect. Failure to examine Project site shall not constitute basis for claims for additional work because of lack of knowledge or location of hidden conditions that affect Project scope.

B. Information on Drawings relative to existing conditions is approximate. Deviations from Drawings necessary during progress of construction to conform to actual conditions shall be approved by the Architect and shall be made without additional cost to the Owner. The Contractor shall be held responsible for damage caused to existing services. Promptly notify the Architect if services are found which are not shown on Drawings.

1.15 WARRANTY

A. Refer to Division 01 for warranty requirements, and duration and effective date of Contractor’s Standard Guarantee.

B. Repair or replace defective work, material, or part that appears within the warranty period, including damage caused by leaks.

C. On failure to comply with the warranty requirements within a reasonable length of time after notification is given, the Architect/Owner shall have the repairs made at the Contractor's expense.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials or equipment of the same type shall be of the same brand wherever possible. All materials shall be new and in first class condition.

B. All sizes, capacities, and efficiency ratings shown are minimum, except that gas capacity is maximum available.

C. Refer to Sections 22 10 00 and 23 80 00 for specific system piping materials.

2.2 MATERIALS AND PRODUCTS

A. No material installed as part of this Work shall contain asbestos.

B. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).

2.3 GAUGES

A. Marsh "Series J", U.S. Gage, Danton 800, or equal, with bronze bushed movement and front recalibration. Dials shall be white with black numerals, 3-1/2 inch dial face. Normal reading shall be at mid-scale. Provide a needle valve on each gauge connection. Supply a gauge piped with branch isolation valves across the inlet and outlet of each pump and where shown on the Drawings.

B. Provide Pete's Plug II, Sisco P/T, or equal, test plug with Nordel core {and gasketed cap}, on inlet and outlet of each coil, boiler, condenser, chiller and heat exchanger and where shown on Drawings.

2.4 THERMOMETERS

A. Marsh, Taylor, Palmer, or equal, 5 inch diameter bimetal dial, adjustable from face, with adjustable positioner, located to be easily read from normal personnel approach. Normal reading shall be at mid-scale.

1. Provide extension for insulation.
2. Provide thermometers with steel bulb chambers and brass separable sockets.

B. Provide Pete's Plug II, Sisco P/T, or equal, test plug with Nordel core, on inlet and outlet of each coil, boiler, and heat exchanger and provide two digital electronic test thermometers for each range of fluid temperature and where shown on Drawings.

2.5 ACCESS DOORS

A. Where floors, walls, or ceilings must be penetrated for access to mechanical equipment, provide access doors, 14 inch by 14 inch minimum size in usable opening. Where entrance of a serviceman may be required, provide 20 inch by 30 inch minimum usable opening. Locate access doors/panels for non-obstructed and easy reach.

1. All access doors less than 7'-0" above floors and exposed to public access shall have keyed locks.

B. Access doors shall match those supplied in Division 08 in all respects, except as noted herein.

C. Provide stainless steel access doors for use in toilet rooms, shower rooms, kitchens and other damp areas. Provide steel access doors with prime coat of baked-on paint for all other areas.

D. Do not locate access doors in highly visible public areas such as lobbies, waiting areas, and primary entrance areas. Coordinate with the Architect when access is required in these areas.

E. Where specific information or details relating to access panels different from the above is shown or given on the Drawings or other Divisions of work, then that information shall supersede this specification.

F. Manufacturers: Subject to compliance with requirements, available manufacturers offering products which may be incorporated into the Work include Milcor, Karp, Nystrom, or Cesco, equal to the following:

1. Milcor

a. Style K (plaster).
b. Style DW (gypsum board).
c. Style M (Masonry).
d. Style "Fire Rated" where required.

2.6 PIPE GUIDES

A. Where flexible connections are indicated on Drawings, provide Metraflex style IV, B-Line, or equal, pipe guides in locations recommended by manufacturer. Maximum spacing from flexible connection to first pipe guide is 4 pipe diameters, and maximum spacing from second pipe guide is 14 pipe diameters.

2.7 EQUIPMENT IDENTIFICATION

A. Identify each piece of equipment with a permanently attached engraved bakelite plate, 1/2 inch high white letters on black background.

2.8 PIPE IDENTIFICATION

A. Identify each piping system and indicate the direction of flow by means of Seton, Inc., Marking Services Inc., Reef Industries, Inc., or equal, pre-tensioned, coiled semi-rigid plastic pipe labels formed to circumference of pipe, requiring no fasteners or adhesive for attachment to pipe.

B. The legends and flow arrows shall conform to ASME A13.1.

2.9 INSULATION WORK

A. General:

1. For insulating domestic hot water pumps, refer to Section 22 50 00, Plumbing Equipment,
2. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).
3. Adhesives and sealants shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.
4. The term "piping" used herein includes pipe, valves, strainers and fittings.
5. Apply insulating cement to fittings, valves and strainers and trowel smooth to the thickness of adjacent covering. Cover with jacket to match piping. Extend covering on valves up to the bonnet. Leave strainer cleanout plugs accessible.
6. Provide pre-formed PVC valve and fitting covers.
7. Provide Calcium Silicate rigid insulation and sheet metal sleeve, 18 inch minimum length at each pipe hanger. Seal ends of insulation to make vapor tight with jacket.
8. Test insulation, jackets and lap-seal adhesives as a composite product and confirm flame spread of not more than 25 and a smoke developed rating of not more than 50 when tested in accordance with UL723 or ASTM E84.
9. Clean thoroughly, test and have approved, all piping and equipment before installing insulation and/or covering.
10. Repair all damage to existing pipe and equipment insulation whether or not caused during the work of this contract, to match existing adjacent insulation for thickness and finish, but conforming to flame spread and smoke ratings specified above.

B. Insulation of Piping:

1. Insulate domestic hot and tempered water with minimum 3-1/2 pounds per cubic foot density fiberglass with ASJ-SSL jacket. Insulation thickness shall be the following:

   a. Pipe 3/4 inches and smaller: 1 inch thick.
   b. Pipe 1 inch through 1-1/2 inches: 1-1/2 inches thick.

c. Pipe 2 inches and larger: 2 inches thick.

2. Insulate domestic hot water piping under slab on grade with Owens Corning Foamglas, preformed pipe insulation, or equal. Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Cover pipe and fittings with insulation manufacturer's recommended jacketing. Insulation thickness shall be the following:

   a. Pipe 3/4 inches and smaller: 2 inches thick.
   b. Pipe 1 inch and larger: 3 inches thick.

3. Insulate domestic cold water piping located within building, outside of insulation envelope in outside walls, vented attic spaces, and unheated spaces, including equipment rooms and below raised floor with 1 inch thick molded fiberglass, minimum 3-1/2 pound per cubic foot density, with ASJ-SSL jacket.
4. Insulate domestic cold water piping located outside building exposed to weather with minimum 3-1/2 pounds per cubic foot density fiberglass with ASJ-SSL jacket. Insulation thickness for all pipe sizes: 2 inches.
5. Insulate roof drain and overflow drain bodies, horizontal sections of rainwater leader piping and overflow piping, and condensate drains within the building envelope with 1 inch thick fiberglass, minimum 3-1/2 pound per cubic foot density, with ASJ-SSL jacket.
6. Exposed insulated piping within the building shall have a Zeston 2000 25/50, Proto Lo-Smoke, or equal, PVC jacket and fitting cover installed over the insulation, applied per manufacturer's instructions. Insulation shall be vapor tight before applying PVC jacket and fitting covers. Verify suitability with manufacturer of insulation. Insulation with pre-applied polymer jacket may be substituted at Contractor's option.
7. Where insulated piping is exposed to the weather apply aluminum jacket secured with 1/2 inch stainless-steel bands on 12 inch centers. Insulation shall be vapor tight before applying metal jacket, and aluminum fitting covers. Install jacketing with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Cover fittings with glass cloth, two coats of Foster Sealfas 30-36, and factory-fabricated aluminum fitting covers, of same material, finish, and thickness as jacket. Insulation shall be vapor tight before applying metal jacket and fitting covers.

   a. Fitting covers:

      1) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
      2) Tee covers.
      3) Flange and union covers.
      4) End caps.
      5) Beveled collars.
      6) Valve covers.
      7) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

   b. Jacket thickness:

1) Pipes 10 inches diameter and smaller: Minimum .016 inch thick jacket with smooth finish.
2) Pipes 12 inches diameter and larger: Minimum .020 inch thick jacket with smooth finish.

PART 3 - EXECUTION

3.1 EXISTING MATERIALS

A. Remove existing equipment, piping, wiring, construction, etc., which interferes with Work of this Contract. Promptly return to service upon completion of work in the area. Replace items damaged by Contractor with new material to match existing.

B. Removed materials which will not be re-installed and which are not claimed by Owner shall become property of Contractor and shall be removed from Project site. Consult Owner before removing any material from Project site. Carefully remove materials claimed by Owner to prevent damage and deliver to Owner-designated storage location.

C. Existing piping and wiring not reused and are concealed in building construction may be abandoned in place and all ends shall be capped or plugged. Remove unused piping and wiring exposed in Equipment Rooms or occupied spaces. Material shall be removed from Project premises. Disconnect power, water, gas, pump or any other active energy source from piping or electrical service prior to abandoning in place.

D. Existing piping, ductwork, and equipment modified or altered as part of this Work shall comply with the most recent applicable code requirements.

3.2 FRAMING, CUTTING AND PATCHING

A. Special framing, recesses, chases and backing for Work of this Section, unless otherwise specified, are covered under other Specification Sections.

B. Contractor is responsible for placement of pipe sleeves, hangers, inserts, supports, and location of openings for the Work.

C. Cutting, patching, and repairing of existing construction to permit installation of equipment, and materials is the responsibility of Contractor. Repair or replace damage to existing work with skilled mechanics for each trade.

D. Cut existing concrete construction with a concrete saw. Do not utilize pneumatic devices.

E. Core openings through existing construction for passage of new piping and conduits. Cut holes of minimum diameter to suit size of pipe and associated insulation installed. Coordinate with building structure, and obtain Structural Engineer's approval prior to coring through existing construction.

3.3 PLUMBING DEMOLITION

A. Refer to Division 01 Sections “Cutting and Patching” and “Selective Demolition” for general demolition requirements and procedures.

B. Disconnect, dismantle and remove mechanical systems, equipment, and components indicated to be removed. Coordinate with all other trades.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping to remain with same or compatible piping material. Refrigerant system must be evacuated per EPA requirements.
3. Equipment to Be Removed: Drain down and cap remaining services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.4 ELECTRICAL REQUIREMENTS

A. Provide adequate working space around electrical equipment in compliance with the California Electrical Code. Coordinate the Mechanical Work with the Electrical Work to comply.

B. Furnish necessary control diagrams and instructions for the controls. Before permitting operation of any equipment which is furnished, installed, or modified under this Section, review all associated electrical work, including overload protection devices, and assume complete responsibility for the correctness of the electrical connections and protective devices. Motors and control equipment shall conform to the Standards of the National Electrical Manufacturers' Association. All equipment and connections exposed to the weather shall be NEMA IIIR with factory-wired strip heaters in each starter enclosure and temperature control panel where required to inhibit condensation.

C. All line voltage and low voltage wiring and conduit associated with the Temperature Control System are included in this Section. Wiring and conduit shall comply with Division 26.

3.5 PIPING SYSTEM REQUIREMENTS

A. Drawing plans, schematic and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction

loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

3.6 PRIMING AND PAINTING

A. Perform priming and painting on the equipment and materials as specified herein.

B. See Division 09 Painting Section(s) for detailed requirements.

C. Priming and Painting:

1. Exposed ferrous metals, including piping, which are not galvanized or factory-finished shall be primed and painted.

    a. Black Steel Piping:

        1) Primer: One coat gray Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, comparable products by Rust-Oleum, Kelly Moore, or equal.
        2) Topcoat: Two coats gray Sherwin-Williams Pro Industrial Waterbased Alkyd Urethane Enamel, comparable products by Rust-Oleum, Kelly Moore, or equal.

2. Metal surfaces of items to be jacketed or insulated except piping shall be given two coats of primer unless furnished with equivalent factory finish. Items to be primed shall be properly cleaned by effective means free of rust, dirt, scale, grease and other deleterious matter and then primed with the best available grade of zinc rich primer. After erection or installation, all primed surfaces shall be properly cleaned of any foreign or deleterious matter that might impair proper bonding of subsequent paint coatings. Any abrasion or other damage to the shop or field prime coat shall be properly repaired and touched up with the same material used for the original priming.
3. Where equipment is provided with nameplate data, the nameplate shall be masked off prior to painting. When painting is completed, remove masking material.

3.7 EXCAVATING

A. Perform all excavating required for work of this Section. Provide the services of a pipe/cable locating service prior to excavating activities to determine location of existing utilities.

B. Unless shown otherwise, provide a minimum of 2'-6" cover above top of pipe to finished grade for all service piping, unless otherwise noted. Trim trench bottom by hand or provide a 4 inch deep minimum bed of sand to provide a uniform grade and firm support throughout entire length of pipe. For all PVC pipe and for PE gas pipe, bed the pipe in 4 inch sand bed. Pipe bedding materials should be clean crushed rock, gravel or sand of which 100 percent will pass a 1 inch sieve. For pipes that are larger than 10 inches in diameter, at least 95 percent should pass a 3/4 inch sieve, and for pipes 10 inches in diameter or smaller, 100 percent should pass a 1/2 inch sieve. All other materials should have a minimum sand equivalent of 50. Only a small proportion of the native soils will meet these requirements

without extensive processing; therefore, importation of pipe bedding materials should be anticipated. Pipe bedding materials shall be compacted in lifts not exceeding 6 inches in compacted thickness. Each lift shall be compacted to not less than 90 percent relative compaction at or above the optimum moisture content, in accordance with ASTM Specification D2940, except that bedding materials graded such that 100 percent of the material will pass a No. 200 sieve shall be compacted in 6 inch lifts using a single pass of a flat-plate, vibratory compactor or vibratory drum. Pipe bedding materials should extend at least to the spring line.

C. Maintain all warning signs, barricades, flares, and red lanterns as required.

D. For all trenches 5 feet or more in depth, submit copy of permit detailed drawings showing shoring, bracing, sloping, or other provisions to be made for worker protection from the hazard of caving ground during the excavation of such trenches. Obtain a permit from the Division of Industrial Safety prior to beginning excavations. A copy of the permit shall be available at the site at all times.

3.8 BACKFILLING

A. Backfill shall comply with applicable provisions of Division 31 of these Specifications.

B. Except under existing or proposed paved areas, walks, roads, or similar surfaces, backfill for other types of pipe shall be made using suitable excavated material or other approved material. Place backfill in 8 inch layers, measured before compaction, and compact with impact hammer to at least 90 percent relative compaction per ASTM D2940.

1. Backfill plastic pipe and insulated pipe with sand for a minimum distance of 12 inches above the top of the pipe. Compact using mechanical tamping equipment.

C. Entire backfill for excavations under existing or proposed pavements, walks, roads, or similar surfaces, under new slabs on grade, shall be made with clean sand compacted with mechanical tamping equipment vibrator to at least 90 percent relative compaction per ASTM D2940. Remove excess earth. Increase the minimum compaction within the uppermost two feet of backfill to 95 percent.

D. Replace or repair to its original condition all sod, concrete, asphalt paving, or other materials disturbed by the trenching operation. Repair within the guarantee period as required.

3.9 PIPING SYSTEMS INSTALLATION

A. At time of final connection, and prior to opening valve to allow pressurization of water and gas piping from existing systems, on site or off site, perform a pressure test to indicate static pressure of existing systems. If pressure on water piping is greater than 80 psi, or gas pressure is not as indicated on Contract Documents, inform Architect immediately. Do not allow piping systems to be pressurized without written consent of the Architect.

B. General:

1. All piping shall be concealed unless shown or otherwise directed. Allow sufficient space for ceiling panel removal.
2. Installation of piping shall be made with appropriate fittings. Bending of piping will not be accepted.
3. Install piping to permit application of insulation and to allow valve servicing.
4. Where piping or conduit is left exposed within a room, the same shall be run true to plumb, horizontal, or intended planes. Where possible, uniform margins are to be maintained between parallel lines and/or adjacent wall, floor, or ceiling surfaces.
5. Horizontal runs of pipes and/or electrical conduit suspended from ceilings shall provide for a maximum headroom clearance. The clearance shall not be less than 6'-6" without written approval from the Architect.
6. Close ends of pipe immediately after installation. Leave closure in place until removal is necessary for completion of installation.
7. Each piping system shall be thoroughly flushed and proved clean before connection to equipment.
8. Pipe the discharge of each relief valve, air vent, backflow preventer, and similar device to floor sink or drain.
9. Install exposed polished or enameled connections with special care showing no tool marks or threads at fittings.
10. Install horizontal valves with valve stem above horizontal.
11. Use reducing fittings; bushings shall not be allowed. Use eccentric reducing fittings wherever necessary to provide free drainage of lines and passage of air.
12. Verify final equipment locations for roughing-in.
13. Service Markers: Mark the location of each plugged or capped pipe with a 4 inch round by 30 inch long concrete marker, set flush with finish grade. Provide 2-1/2 inch diameter engraved brass plate as part of monument marker.
14. Furnish and install anchors or thrust blocks on PVC water lines in the ground, at all changes in direction of piping, and at all connections or branches from mains 1-1/2 inch and larger. Form anchors or thrust blocks by pouring concrete between pipe and trench wall. Thrust blocks shall be of adequate size and so placed as to take thrusts created by maximum internal water pressure. Sizing and placement shall be per manufacturer's recommendations, CPC, and IAPMO installation standards. Anchor piping to building construction.
15. Sanitary Sewer and Storm Drain: Grade piping inside building uniformly 1/4 inch per foot if possible but not less than 1/8 inch per foot. Run piping as straight as possible. Make piping connections between building piping and outside service pipe with cast iron reducers or increasers. Slope sewers uniformly between given elevations where invert elevations are shown.
16. Where piping is installed in walls within one inch of the face of stud, provide a 16 gauge sheet metal shield plate on the face of the stud. The shield plate shall extend a minimum of 1-1/2 inches beyond the outside diameter of the pipe.

C. Sleeves:

1. Install Adjus-to-Crete, Pipeline Seal and Insulator, or equal, pipe sleeves of sufficient size to allow for free motion of pipe, 24 gauge galvanized steel. The space between pipe and sleeves through floor slabs on ground, through outside walls above or below grade, through roof, and other locations as directed shall be caulked with oakum and mastic and made watertight. The space between pipe and sleeve and between sleeve and slab or wall shall be sealed watertight.

2. At Contractor's option, Link-Seal, Metraflex Metraseal, or equal, casing seals may be used in lieu of caulking. Wrap pipes through slabs on grade with 1 inch thick fiberglass insulation to completely isolate the pipe from the concrete.

D. Floor, Wall, and Ceiling Plates:

1. Fit all pipes with or without insulation passing through walls, floors, or ceilings, and all hanger rods penetrating finished ceilings with chrome-plated or stainless escutcheon plates.

E. Firestopping:

1. Pack the annular space between the pipe sleeves and the pipe through all floors and walls with UL listed fire stop, and sealed at the ends. All pipe penetrations shall be UL listed, Hilti, 3M Pro-Set, or equal.

    a. Install fire caulking behind mechanical services installed within fire rated walls, to maintain continuous rating of wall construction.

2. Provide SpecSeal Systems UL fire rated sleeve/coupling penetrators for each pipe penetration or fixture opening passing through floors, walls, partitions or floor/ceiling assemblies. All Penetrators shall comply with UL Fire Resistance Directory (Latest Edition), and in accordance with Chapter 7, CBC requirements.
3. Sleeve penetrators shall have a built in anchor ring for waterproofing and anchoring into concrete pours or use the special fit cored hole penetrator for cored holes.
4. Copper and steel piping shall have SpecSeal plugs on both sides of the penetrator to reduce noise and to provide waterproofing.
5. All above Systems to be installed in strict accordance with manufacturer's instructions.
6. Alternate firestopping systems are acceptable if approved equal. However, any deviation from the above specification requires the Contractor to be responsible for determining the suitability of the proposed products and their intended use, and the Contractor shall assume all risks and liabilities whatsoever in connection therewith.

F. Flashing:

1. Flashing for penetrations of metal or membrane roof for mechanical items such as flues and pipes shall be coordinated with the roofing manufacturer and roofing installer for the specific roofing type. The work of this section shall include furnishing, layout, sizing, and coordination of penetrations required for the mechanical work.

    a. Furnish and install flashing and counterflashing in strict conformance with the requirements of the roofing manufacturer. Submit shop drawing details for review prior to installation.
    b. Furnish and install counterflashing above each flashing required. Provide vandalproof top and flashing combination. Provide vandalproof top for each plumbing vent through roof. JR Smith Model 1748, or equal.

G. Hangers and Supports:

1. General: Support equipment and piping so that it is firmly held in place by approved iron hangers and supports and special hangers. Hanger and support components shall support weight of equipment and pipe, fluid, and pipe insulation based on spacing between supports with minimum factor of safety of five based on ultimate strength of material used. Do not exceed manufacturer's load rating. Pipe attachments or hangers, of same size as pipe or tubing on which used, or nearest available. Rigidly fasten hose faucets, fixture stops, compressed air outlets, and similar items to the building construction. The Architect shall approve hanger material before installation. Do not support piping with plumbers' tape, wire rope, wood, or other makeshift devices. Where building structural members do not match piping support spacing, provide "bridging" support members firmly attached to building structural members in a fashion approved by the structural engineer.

    a. Materials, design, and type numbers per Manufacturers' Standardization Society (MSS), Standard Practice (SP)-58.

        1) Provide copper-plated or felt-lined hangers for use on copper tubing.

2. Hanger components shall be provided by one manufacturer: B-Line, Grinnell, Unistrut, Badger, or equal.
3. Riser clamps: B-line model B3373, or equal.
4. Pipe Hanger and Support Placement and Spacing:

    a. Vertical piping support spacing: Provide riser clamps for piping, above each floor, in contact with the floor. Provide support at joints, branches, and horizontal offsets. Provide additional support for vertical piping, spaced at or within the following maximum limits:

Pipe Diameter	Steel Threaded or Welded (Note 3)	Steel Gas	Copper Brazed or Soldered (Note 3)	CPVC & PVC (Note 2)
1/2 - 1"	12 ft.	6 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)
1-1/4 - 2"	12 ft.	Each Floor, Not to Exceed 10 ft.	Each Floor, Not to Exceed 10 ft..	Base and Each Floor (Note 1)
2-1/2 - 3"	12 ft.	Each Floor, Not to Exceed 10 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)
Over 4"	12 ft.	Each Floor, Not to Exceed 10 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)

1) Note 1: Provide mid-story guides.
2) Note 2: For PVC piping, provide for expansion every 30 feet per IAPMO installation standard. For CPVC piping, provide for expansion per IAPMO installation standard.
3) Note 3: Spacing of hangers and supports for piping assembled with mechanical joints shall be in accordance with standards acceptable to authorities having jurisdiction.

b. Vertical cast iron piping support spacing: Base and each floor not to exceed 15 feet.

c. Horizontal piping, hanger and support spacing: Locate hangers and supports at each change of direction, within one foot of elbow, and spaced at or within following maximum limits:

Pipe Diameter	Steel Threaded or Welded (Note 2)	Steel Gas	Copper Brazed or Soldered (Notes 2, 3)	CPVC & PVC (Note 1)
1/2 - 1"	6 ft.	6 ft.	5 ft.	3 ft.
1-1/4 - 2"	7 ft.	10 ft.	6 ft.	4 ft.
2-1/2 - 3"	10 ft.	10 ft.	10 ft.	4 ft.
Over 4"	10 ft.	10 ft.	10 ft.	4 ft.

1) Note 1: For PVC piping, provide for expansion every 30 feet per IAPMO installation standard. For CPVC piping, provide for expansion per IAPMO installation standard.
2) Note 2: Spacing of hangers and supports for piping assembled with mechanical joints shall be in accordance with standards acceptable to authorities having jurisdiction.
3) Note 3: Includes all refrigerant piping, including vapor and hot gas pipes.

d. Horizontal cast iron piping support spacing:

1) Support piping at every other joint for piping length of less than 4 feet.
2) For piping longer than 4 feet, provide support on each side of the coupling, within 18 inches of each joint.
3) Hanger shall not be installed on the coupling.
4) Provide support at each horizontal branch connection.
5) Provide a brace on each side of a change in direction of 90 degrees or more.

5. Suspended Piping:

a. Individually suspended piping: B-Line B3690 J-Hanger or B3100 Clevis, complete with threaded rod, or equal. All hangers on supply and return piping

handling heating hot water or steam shall have a swing connector at point of support.

Pipe Size	Rod Size Diameter
2" and Smaller	3/8"
2-1/2" to 3-1/2"	1/2"
4" to 5"	5/8"
6"	3/4"

b. Trapeze Suspension: B-Line 1-5/8 inch width channel in accordance with manufacturer's published load ratings. No deflection to exceed 1/180 of a span.
c. Trapeze Supporting Rods: Shall have a safety factor of five; securely anchor to building structure.
d. Pipe Clamps and Straps: B-Line B2000, B2400; isolate copper pipe with two thicknesses of 2 inches wide 10-mil polyvinyl tape. Where used for seismic support systems, provide B-Line B2400 series pipe straps.

6. Support to Structure:

a. Wood Structure: Provide and install wood blocking as required to suit structure. Provide lag screws or through bolts with length to suit requirements, and with size (diameter) to match the size of hanger rods required.

1) Do not install Lag screws in tension without written review and acceptance by Structural Engineer.

Side Beam Angle Clip	B-Line B3062---MSS Type 34
Side Beam Angle Clip	B-Line B3060
Ceiling Flange	B-Line B3199

2) Blocking for support of piping shall be not less than 2 inch thick for piping up to 2 inch size. Provide 3 inch blocking for piping up through 5 inch size, and 4 inch blocking for larger piping. Provide support for blocking in accordance with Structural Engineers requirements.
3) Where lag screws are used, length of screw shall be 1/2 inch less than the wood blocking. Pre-drill starter holes for each lag screw.

7. Rubber Neoprene Pipe Isolators:

a. Pipe isolators shall comprise an internal rubber or neoprene material that isolates pipe from hanger and structure. Install at all piping located in acoustical walls. Refer to Architectural Drawings for location of acoustical walls.

b. Isolation material shall be either a rubber or neoprene material that prevents contact between the pipe and the structure. The rubber shall have between a 45 to 55 durometer rating and a minimum thickness of 1/2 inch.
c. Acceptable Suppliers:

1) Vertical runs: Acousto-Plumb or equal.
2) Horizontal runs: B-Line, Vibraclamp; Acousto-Plumb or equal.

8. Provide support for piping through roof, arranged to anchor piping solidly in place at the roof penetration.
9. Provide rigid insulation and a 12 inch long, 18 gauge galvanized sheet iron shield between the covering and the hanger whenever hangers are installed on the outside of the pipe covering.
10. Insulate copper tubing from ferrous materials and hangers with two thicknesses of 3 inch wide, 10 mil polyvinyl tape wrapped around pipe.
11. Provide a support or hanger close to each change of direction of pipe either horizontal or vertical and as near as possible to concentrated loads.
12. Suspend rods from concrete inserts with removable nuts where suspended from concrete decks. Power actuated inserts will not be allowed.

3.10 UNION AND FLANGE INSTALLATION

A. Install Watts, Epco, Nibco, or equal, dielectric unions or flanges at points of connection between copper or brass piping or material and steel or cast iron pipe or material except in drain, waste, vent, or rainwater piping. Bushings or couplings shall not be used. Dielectric unions installed in potable water systems shall conform to the lead-free requirements of the California Health and Safety Code Section 11 68 75.

B. Install unions in piping NPS 2” and smaller, and flanges in piping NPS 2-1/2” and larger whether shown or not at each connection to all equipment and tanks, and at all connections to all automatic valves, such as temperature control valves. Unions installed in potable water systems shall conform to the lead-free requirements of the California Health and Safety Code Section 11 68 75.

C. Locate the unions for easy removal of the equipment, tank, or valve.

3.11 ACCESS DOOR INSTALLATION

A. Furnish and install access doors wherever required whether shown or not for easy maintenance of mechanical systems; for example, at concealed valves, strainers, traps, cleanouts, dampers, motors, controls, operating equipment, etc. Access doors shall provide for complete removal and replacement of equipment.

3.12 CONCRETE WORK

A. Concrete work required for work of this Section shall be included under another section of the Specification, unless otherwise noted, including poured-in-place concrete work for

installing precast manholes, catch basins, etc., and shall include reinforced concrete bases for pumps, tanks, compressors, fan units, boilers, unless the work is specifically indicated on the Drawings to be furnished under this Section.

B. Thrust blocks, underground anchors, and pads for cleanouts, valve access boxes and washer boxes are included under this Section of the Specification. Concrete shall be 3000 psi test minimum. Refer to Division 03 for concrete types.

3.13 PIPE PROTECTION

A. Wrap bare galvanized and black steel pipe buried in the ground and to 6" above grade, including piping in conduit, with one of the following, or equal:

1. Polyethylene Coating: Pressure sensitive polyethylene coating, "X-Tru-Coat" as manufactured by Pipe Line Service Corporation or "Green Line" wrap as manufactured by Roystron Products, or equal.

    a. Field Joints and Fittings: Protecto Wrap #1170 tape as manufactured by Pipe Line Service Corporation, or Primer #200 tape by Roystron Products, or equal. Installation shall be as per manufacturer's recommendation and instructions.

2. Tape Wrap: Pressure-sensitive polyvinyl chloride tape, "Transtex #V-l0 or V-20", "Scotchwrap 50", Slipknot l00, PASCO Specialty & Mfg., Inc., or equal, with continuous identification. Tape shall be a minimum of 20 mils thick for fittings and irregular surfaces, two wraps, 50 percent overlap, 40 mils total thickness. Tape shall be laminated with a suitable adhesive; widths as recommended by the manufacturer for the pipe size. Wrap straight lengths of piping with an approved wrapping machine.

B. Field Joints: Valves and Fittings: double wrap polyvinyl chloride tape as above. Provide at least two thicknesses of tape over the joint and extend a minimum of 4 inches over adjacent pipe covering. Build up with primer to match adjacent covering thickness. Width of tape of fittings shall not exceed 3 inches. Tape shall adhere tightly to all surfaces of the fittings without air pockets.

C. Testing: Test completed wrap of piping, including all epoxy painted piping with Tinker and Rasor Co. test machine (San Gabriel, CA - 818-287-5259), Pipeline Inspection Company (Houston, TX - 713-681-5837), or equal.

D. Cleaning: Clean all piping thoroughly before wrapping.

1. Inspection: Damaged or defective wraps shall be repaired as directed. No wrapped pipe shall be covered until approved by Architect.

E. Sleeve copper piping/tubing installed below slab with “Polywrap-C” polyethylene sleeve, as manufactured by Northtown Pipe Protection Products, or equal. Sleeve shall be a minimum of 6 mils thick, colored blue for domestic water piping and orange for other piping. Install sleeve per manufacturer’s recommendations and instructions.

F. Sleeve copper piping/tubing installed outside building below grade with “Polywrap-C” polyethylene sleeve, as manufactured by Northtown Pipe Protection Products, or equal. Sleeve shall be a minimum of 6 mils thick, colored blue for domestic water piping. Install sleeve per manufacturer’s recommendations and instructions.

G. Sleeve cast iron and ductile iron pipe below grade and below slab with “Polywrap” polyethylene sleeve, as manufactured by Northtown Pipe Protection Products, or equal. Sleeve shall be a minimum of 8 mils thick, colored natural. Install sleeve per manufacturer’s recommendations and instructions.

H. Covering: No rocks or sharp edges shall be backfilled against the wrap or sleeve. When backfilling with other than sand, protect wrap with an outer wrapping of Kraft paper; leave in place during backfill.

3.14 PIPE IDENTIFICATION

A. Provide temporary identification of each pipe installed, at the time of installation. Temporary identification shall be removed and replaced with permanent identification as part of the work.

B. Apply the legend and flow arrow at all valve locations; at all points where the piping enters or leaves a wall, partition, cluster of piping or similar obstruction, at each change of direction and at approximately 20'-0" intervals on pipe runs. Variations or changes in locations and spacing may be made with the approval of the Architect. There shall be at least one marking in each room. Markings shall be located for maximum visibility from expected personnel approach.

1. Apply legend and flow arrow at approximately 10’-0” intervals in science classrooms and science prep rooms.

C. Wherever two or more pipes run parallel, the markings shall be supplied in the same relative location on each.

D. Each valve on non-potable water piping shall be labeled with a metal tag stamped "DANGER -- NON-POTABLE WATER" in 1/4 inch high letters.

E. Apply markings after painting and cleaning of piping and insulation is completed.

3.15 EXPANSION ANCHORS IN HARDENED CONCRETE

A. Refer to Structural Drawings.

3.16 PIPING SYSTEM PRESSURE TESTING

A. General:

1. Perform operational tests under simulated or actual service conditions, including one test of complete plumbing installation with fixtures and other appliances connected.
2. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.

B. Piping Systems: Test piping systems in accordance with the following requirements and applicable codes:

1. Authority having jurisdiction shall witness tests of piping systems.
2. Notify Architect at least seven days in advance of testing.
3. All piping shall be tested at completion of roughing-in, or at other times as directed by Architect.
4. Furnish necessary materials, test pumps, gases, instruments and labor required for testing.
5. Isolate from system equipment that may be damaged by test pressure.
6. Make connections to existing systems with flanged connection. During testing of new work, provide a slip-in plate to restrict test pressure to new systems. Remove plate and make final connection to existing system at completion of testing.

    a. Authority having jurisdiction shall witness final connection to system.

C. Test Schedule: No loss in pressure or visible leaks shall show after four hours at the pressures indicated.

D. Testing of Sanitary Sewer, Drain, Vent, and Storm Drain may be done in segments in order to limit pressure to within manufacturer's recommendations. Test to 10 feet above highest point in the system.

System Tested	Test Pressure PSI	Test With
Sanitary Sewer, Drain, Vent	10 Ft. Hd.	Water
Storm Drain, Condensate Drains	10 Ft. Hd.	Water
Domestic Water	125	Water
Natural Gas (PE)	60	Air & Non-corrosive Leak Test Fluid
Natural Gas (Steel)	100	Air & Non-corrosive Leak Test Fluid

1. Flush deionized water lines with deionized water after test and approval.
2. Non-corrosive leak test fluid shall be suitable for use with piping material specified, and with the type of gas conveyed by the piping system.

3.17 OPERATION OF SYSTEMS

A. Do not operate any plumbing equipment for any purpose, temporary or permanent, until all of the following has been completed:

1. Complete all requirements listed under "Check, Test and Start Requirements."
2. Piping has been properly cleaned. Piping systems shall be flushed and treated prior to operation.
3. Filters, strainers etc. are in place.
4. Bearings have been lubricated, and alignment of rotating equipment has been checked.
5. Equipment has been run under observation, and is operating in a satisfactory manner.

B. Provide test and balance agency with one set of Contract Drawings, Specifications, Addenda, Change orders issued, applicable shop drawings and submittals and temperature control drawings.

3.18 CHECK, TEST AND START REQUIREMENTS

A. An authorized representative of the equipment manufacturer shall perform check, test and start of each piece of plumbing equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the check test and start of the equipment.

1. As part of the submittal process, provide a copy of each manufacturer's printed startup form to be used.
2. Some items of specified equipment may require that check, test and start of equipment must be performed by the manufacturer, using manufacturer's employees. See specific equipment Articles in these Specifications for this requirement.
3. Provide all personnel, test instruments, and equipment to properly perform the check, test and start work.
4. When work has been completed, provide copies of reports for review, prior to final observation of work.

B. Provide copies of the completed check, test and start report of each item of equipment, bound with the Operation and Maintenance Manual.

C. Upon completion of the work, provide a schedule of planned maintenance for each piece of equipment. Indicate frequency of service, recommended spare parts (including filters and lubricants), and methods for adjustment and alignment of all equipment components. Provide a copy of the schedule with each operating and maintenance manual. Provide a copy of certification from the Owner's representative indicating that they have been properly instructed in maintenance requirements for the equipment installed.

3.19 CERTIFICATES OF INSTALLATION

A. Contractor shall complete applicable "Certificates of Installation" forms contained in the California Building Energy Efficiency Standards and submit to the authorities having

jurisdiction for approval and issuance of final occupancy permit, as described in the California Energy Code.

3.20 DEMONSTRATION AND TRAINING

A. An authorized representative of the equipment manufacturer shall train Owner-designated personnel in maintenance and adjustment of equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the Owner training for the equipment installed.

1. As part of the submittal process, provide a training agenda outlining major topics and time allowed for each topic.
2. Some items of specified equipment require that training must be performed by the manufacturer, using manufacturer's employees. See specific equipment Articles in these Specifications for this requirement.
3. Contractor shall provide three copies of certification by Contractor that training has been completed, signed by Owner's representative, for inclusion in Operation and Maintenance Manual. Certificates shall include:

    a. Listing of Owner-designated personnel completing training, by name and title.
    b. Name and title of training instructor.
    c. Date(s) of training.
    d. List of topics covered in training sessions.

4. Refer to specific equipment Articles for minimum training period duration for each piece of equipment.

END OF SECTION 22 00 50

SECTION 22 10 00 - PLUMBING PIPING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Valves.
3. Domestic water piping specialties.
4. Drain and waste piping specialties.

1.2 RELATED REQUIREMENTS

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

B. Section 22 00 50 Basic Plumbing Materials and Methods.

1.3 ACTION SUBMITTALS

A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.

B. Product Data: Submit manufacturer's technical product data and installation instructions for plumbing piping systems materials and products.

1.4 INFORMATIONAL SUBMITTALS

A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.

B. Gas Pipe Installer Qualifications: Provide evidence of current qualifications for individuals performing work requiring qualifications.

1.5 CLOSEOUT SUBMITTALS

A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.

B. Maintenance Data: Submit maintenance data and parts lists for plumbing piping systems materials and products. Include this data in Operation and Maintenance Manual.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish to Owner, with receipt, one valve key for each key operated hydrant, bibb, or faucet installed.

1.7 QUALITY ASSURANCE

A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.

PART 2 - PRODUCTS

2.1 MATERIALS AND PRODUCTS

A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Provide materials and products complying with California Plumbing Code. Where more than one type of material or product is indicated, selection from materials or products specified is Contractor's option.

B. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372. Plastic piping components shall be marked with "NSF-pw."

2.2 PIPE AND FITTINGS ATTACHED TO AND BELOW BUILDINGS INCLUDING 5 FEET FROM BUILDINGS

A. Piping and fittings attached to covered walkways and corridors shall comply with the requirements of this article.

B. Drain and Waste Pipe Above Grade: Cast iron soil pipe and fittings, asphaltic coated, conforming to ASTM A888 and Cast Iron Soil Pipe Institute Standard (CISPI) 301 and so marked. Pipe and fittings shall be as manufactured by AB&I, Charlotte, Tyler Pipe, or equal. Pipe and fittings shall be the products of a single manufacturer. At Contractor’s option, vertical piping above floor from lavatories, sinks, and drinking fountains may be Schedule 40 galvanized steel pipe with black cast iron drainage fittings, or DWV weld pipe and fittings.

1. Joints above grade: No-Hub pipe conforming to ASTM A888 and CISPI 301. Couplings conforming to ASTM 1277 and CISPI 310, with stainless steel bands. Provide products by ANACO-Husky, Tyler, Ideal or equal. Provide sway brace at 20'-0" maximum spacing for suspended pipe with No-Hub joints. Provide a brace on each side of a change in direction of 90 degrees or more. Brace riser joints at each floor and at 15 foot maximum intervals (also see Specification Section 22 00 50).

a. Joints located over critical areas including food preparation, food storage, food serving, and eating areas shall be ANACO-Husky SD 4000, Clamp-All 125, or equal, meeting the requirements of FM 1680, SD Class I and ASTM C1540.

C. Drain and Waste Pipe Below Grade: Cast iron soil pipe and fittings, asphaltic coated, conforming to ASTM A888 and CISPI 301 and so marked. Pipe and fittings shall be as manufactured by AB&I, Charlotte, Tyler Pipe, or equal. Pipe and fittings shall be the products of a single manufacturer. At Contractor's option, hub and spigot cast iron soil pipe and fittings, asphaltic coated, conforming to ASTM A-74 and so marked, may be used.

1. Joints below grade: ANACO-Husky SD 4000, Clamp-All 125, or equal couplings and No-Hub fittings, meeting the requirements of FM 1680, SD Class I and ASTM C1540.
2. Joints below grade (hub and spigot option): Neoprene gaskets conforming to ASTM C564, as manufactured by Ty-Seal, Dual-Tite, or equal.

D. Vent Pipe:

1. 3 inch and larger: Cast iron soil pipe and fittings conforming to ASTM A888 and Cast Iron Soil Pipe Institute Standard 301 and so marked. Joints in cast iron vent pipe shall be the same as specified for cast iron waste pipe above grade.
2. 2-1/2 inch and smaller: Cast iron soil pipe and fittings as specified for sizes 3 inch and larger, Schedule 40 galvanized steel pipe with black cast iron drainage fittings, or DWV copper pipe and fittings.
3. Vent pipe buried in ground and to 6 inches above ground: Cast iron soil pipe and fittings conforming to ASTM A888 and Cast Iron Soil Pipe Institute Standard 301 and so marked. Joints in cast iron vent pipe shall be the same as specified for cast iron waste pipe below ground.

E. Water Pipe (Tempered Water, Tempered Water Return, Hot Water, Hot Water Return and Cold Water): ASTM B88, Type L copper tubing, hard-temper, with wrought copper fittings. Provide full solder cup for all fittings. Capped or plugged outlets shall be Schedule 40 screwed brass. Water piping below slab: ASTM B88, Type K copper tubing, hard temper, with wrought copper fittings. At Contractor's option, pipe runs below slab having no branches may be ASTM B88, Type K annealed copper tubing without joints. See Section 22 00 50 for pipe protection requirements for below slab copper piping.

F. Temperature and Pressure Relief Valve Piping: ASTM B88, Type L copper tubing, hard-temper, with wrought copper fittings. Provide full solder cup for all fittings. Capped or plugged outlets shall be Schedule 40 screwed brass.

G. Condensate Drain Piping:

1. Inside buildings provide ASTM B88, Type L copper tubing and fittings. Provide Wye fittings with capped cleanout plug for tubing up to 1 inch size. Provide wrought or cast DWV fittings for sizes 1-1/4 inch and larger.
2. Outside buildings provide ASTM B88, Type L copper pipe and fittings, cast iron drain pipe and fittings or Schedule 40 galvanized steel pipe and cast iron drain or vent fittings.
3. Connect condensate drains to mechanical equipment per equipment manufacturer's recommendations; provide P-trap where required. Slope piping to drain, with 1 inch in 10 foot minimum pitch. Provide di-electric couplings or unions at connections to dissimilar materials.

4. Where Drawings indicate installation of mechanical equipment on spring isolation rails spring mounted curbs, or spring hangers, provide threaded metal connector at mechanical equipment, Metraflex Model SST, or equal by Unisource Mfg. Co., or Flexicraft Industries. Arrange flexible connection to ensure drainage of condensate, and support flexible connection at each end of connector, to ensure proper alignment.
5. Where condensate drain P-traps are required, install trap using Wye fitting on inlet and outlet of trap. Provide cap on top of each Wye, made removable for cleaning and inspection. Drill 1/8 inch diameter hole in cap at outlet of the trap to allow venting of the system. Minimum depth of trap should be 4 inches, or as recommended by the manufacturer in printed literature.
6. Provide cleanout tees or "Y" at each change in direction.

2.3 FIRE PROTECTION PIPING

A. Refer to specification Section 21 10 00 "Fire Protection."

2.4 PIPE JOINING MATERIALS

A. Refer to piping Articles in this Section for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated

    a. Full-Face Type: For flat-face, Class 125, cast iron and cast bronze flanges.
    b. Narrow-Face Type: For raised-face, Class 250, cast iron and steel flanges.

2. AWWA C111, rubber, flat face, 1/8-inch (3.2mm) thick, unless otherwise indicated; and full-face or ring type, unless other indicated.
3. Flange Bolts and Nuts: AWWA C111, carbon steel, unless otherwise indicated.
4. Plastic, Pipe-Flange Gasket, Bolts and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, 100 percent lead free alloys. Include water-flushable flux according to ASTM B813.

D. Brazing Filler Metals: AWS A5.8, BCup-5 Series, copper-phosphorus unless otherwise indicated. Sil-Fos 15, or equal.

2.5 VALVES AND FITTINGS FOR POTABLE WATER SYSTEMS

A. General:

1. Provide valves and fittings conforming to lead-free requirements of California Health and Safety Code Section 11 68 75.

a. Provide valves listed to NSF/ANSI 61-G or NSF/ANSI 372 for valve materials for potable-water service.

1) Exception: Main distribution gate valves above 1-1/2 inches located underground outside building are not required to conform lead-free requirements of California Health and Safety Code Section 11 68 75.

B. Gate Valves:

1. General: Furnish valves in copper lines with adapters to suit valve/line requirements.
2. 1-1/2 inches and smaller: Minimum 200 psi CWP, bronze body, threaded bonnet, rising or non-rising stem, solid wedge, threaded or solder ends, conforming to MSS SP-80. Milwaukee UP148, UP149, Nibco T-113-LF, S-113-LF, or equal.
3. 2 inches through 3 inches: Minimum 200 psi CWP, bronze body, threaded bonnet, non-rising stem, solid wedge, threaded or solder ends, conforming to MSS SP-80. Nibco T-113-LF, S-113-LF, or equal.
4. Main distribution gate valves underground outside building above 1-1/2 inches:

a. Underground valves 2 inches thru 12 inches: 250 psi, iron body, Non-rising stem, bolted bonnet, resilient wedge valves, conforming to AWWA C509, equipped with operating nuts, Mueller Series 2360, Nibco F-619-RW-SON, or equal.

1) Underground valves 3 inches and smaller may be furnished with operating nuts or hand-wheels, and with Ring-Tite joint ends.
2) Furnish and deliver to Owner one wrench of each size required for operating underground valves.

C. Ball Valves:

1. 2 inches and smaller: 600 psi CWP, cast bronze or brass body, full port, two piece, threaded ends, and reinforced PTFE seal, conforming to MSS SP-110. Nibco T-685-80-LF, Milwaukee UPBA400, Apollo 77C-LF10, Kitz 868, or equal.
2. 2-1/2 inches: Apollo 77C-LF10, or equal.

D. Swing Check Valves:

1. Minimum 200 psi CWP, bronze or brass body, suitable for regrinding, threaded ends, conforming to MSS SP-80. Milwaukee UP509, Nibco T-413LF, Kitz 822T, or equal.

E. Butterfly Valves:

1. General: Tight closing, full lug type, with resilient seat suitable for minimum working pressure of 200 psig, conforming to MSS SP-67. Bi-direction dead end service with downstream flange removed.
2. Provide valves with the following:

a. Seats: suitable for 40 degrees F for cold water service and 250 degrees F for hot water service. Seats shall cover inside surface of body and extend over body ends.

b. Bodies: ductile iron or cast iron.
c. Discs: Bronze or stainless steel.
d. Stems or Shafts: Stainless steel. Install valves with stems horizontal.
e. Control Handles: Suitable for locking in any position or with 10 degree or 15 degree notched throttling plates to hold valve in selected position. Provide extended necks to compensate for insulation thickness. Provide gear operator for valves 5 inches and larger.

3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. 2 through 12 inches: Watts Regulator Co., model DBF-03.

F. Silent Check Valves (for use on pump discharge):

1. General: Provide spring loaded check valves at pump discharge of all pumps.

a. 2 inches and smaller: Minimum 300 psi CWP, bronze body, Apollo 61LF, Milwaukee UP548-T, or equal.
b. 2-1/2 inches and larger: Class 250, cast iron body, suitable for regrinding, Mueller 103MAP, or equal.

G. Calibrated Balancing Valves:

1. General: Calibrated orifice ball type rated for 400 psig maximum operating pressure and 250 degrees F. maximum operating temperature.

a. Body: Brass.
b. Ball: 304 Stainless Steel.
c. Seat: Glass and Carbon filled TFE.
d. End Connections: Threaded.
e. Pressure Gage connections: Integral capped readout valves with internal check valves and drain port, for use with portable pressure differential meter.
f. Handle Style: Dial, with memory stops to retain set position.

2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. 3 Inch and Smaller: Bell & Gossett model CB, “LF” series.

2.6 DOMESTIC WATER PIPING SPECIALTIES

A. Hose Bibbs:

1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:

a. Acorn Engineering Co.
b. Woodford Manufacturing Co.

2. Hose Station: Leonard THS-25-VB-CW, Symmons, or equal.

B. Wall Hydrants:

1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:

a. Acorn Engineering Co.
b. Woodford Manufacturing Co.
c. Mifab, Inc.

C. Water Hammer Arrestors:

1. Provide water hammer arrestors conforming to lead-free requirements of California Health and Safety Code Section 11 68 75, with nesting type bellows contained within a casing having sufficient displacement volume to dissipate the calculated kinetic energy generated in the piping system. Water hammer arrestors shall be sized for type and number of fixtures served. Provide all stainless steel shell construction with stainless steel bellows and threaded connection to water system.
2. Water hammer arrestors shall be certified under P.D.I. Standard WH201 and by ASSE Standard 1010.
3. Select units in accordance with the requirements of Plumbing and Drainage Institute Standard P.D.I. WH201. Install above ceilings or behind wall access door at each plumbing fixture, or where plumbing fixtures are installed in groups, at each group of fixtures.
4. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Josam Company, series 75000.
b. Smith (Jay R.) Mfg. Co., Hydrotrol 5005-5050.
c. Mifab, series WHB.

D. Potable Water Pressure-Regulating Valve:

1. Provide pressure-regulating valves, single-seated, direct-operated type, bronze body, integral strainer, complying with requirements of ASSE Standard 1003, and the lead-free requirements of California Health and Safety Code Section 11 68 75. Size for maximum flow rate and inlet and outlet pressure indicated on Drawings.
2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Cla-Val Company.
b. Watts Regulator Company.

E. Relief Valves:

1. Provide relief valves as indicated, of size and capacity as selected by Contractor for proper relieving capacity, in accordance with ASME Boiler and Pressure Vessel Code.
2. Combined Pressure-Temperature Relief Valves: Bronze body, test lever, thermostat, complying with ANSI A21.22 listing requirements for temperature discharge capacity. Provide temperature relief at 210 degrees F, and pressure relief at 150 psi.
3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

    a. Watts Regulator Company.
    b. Cash (A.W.) Valve Manufacturing Corporation.
    c. Zurn Industries, Inc.; Wilkins-Regulator Division.

F. Trap Primers:

1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:

    a. MiFab, Inc.
    b. Precision Plumbing Products.
    c. Sioux Chief Manufacturing Company.

2.7 DRAIN AND WASTE PIPING SPECIALTIES

A. Cleanouts:

1. General: Install cleanouts of same diameter as pipe (4 inch maximum) in all horizontal soil and waste lines where indicated and at all points of change in direction. Cleanouts shall be located not less than 18 inches from building construction so as to provide sufficient space for rodding. No horizontal run over 50 feet inside buildings or 100 feet outside buildings shall be without cleanout, whether shown on Drawings or not. Provide two-way cleanouts where indicated on drawings, and where required for satisfactory use.

    a. Provide cleanouts in waste drop from each sink and urinal.
    b. Provide one wrench for each size and type of cleanout used. Turn over to Owner at completion of the project, and obtain receipt. Place receipt in Operation and Maintenance Manuals.

2. Cleanouts in floor and in concrete sidewalks: Ducco Cast Iron with nickel bronze top, clamping collar and ABS plastic plug: Zurn ZN-1400-KC, or equal, with square or round top to suit floor construction.
3. Cleanouts in composition floors: Zurn ZN-1400-X-DX, or equal (nickel bronze top).
4. Cleanouts in concealed, aboveground cast-iron soil or waste lines: Zurn Z-1440A, or equal, with ABS plastic plug.

5. Cleanouts in walls: Zurn Z-1441 or Z-1443, or equal, with stainless steel cover. Provide long sweep elbow or combination wye at connection to riser and install with surface of cleanout within ½ inch of front face of finished wall.

    a. Where space does not permit the above installation, provide Zurn Z-1446, or equal, with stainless steel access cover, and vandal resistant screw.
    b. Install face of cleanout plug within 1/2 inch of front face of finished wall.

B. Floor Drains:

1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:

    a. J.R. Smith.
    b. MIFAB.
    c. Watts.
    d. Zurn.

C. Floor Sinks:

1. Floor Sinks: Provide anchoring flange (seepage pan) at all floor sinks, and provide flashing clamp in locations where floor membrane is used. Provide cast iron "P" trap and trap primer connection at P-Trap.
2. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:

    a. J.R. Smith.
    b. MIFAB.
    c. Watts.
    d. Zurn.

D. Hopper Drains:

1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:

    a. Zurn.
    b. J.R. Smith.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which plumbing piping systems are to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable to Contractor.

B. Make all arrangements for the utilities required. Pay all costs involved in obtaining the services including gas service and meter, water meter, pressure reducing valve, access boxes, street work. Connect to site utilities. Verify the location of all services. No extra cost will be allowed if services are not as shown.

C. At time of final connection, and prior to opening valve to allow pressurization of water and gas piping from existing systems, on site or off site, perform a pressure test to indicate static pressure of existing systems. If pressure on water piping is greater than 80 psi, or gas pressure is not as indicated on Contract Documents, inform Architect immediately. Do not allow piping systems to be pressurized without written consent of the Architect.

3.2 INSTALLATION OF WATER PIPING

A. Run all water piping generally level, free of traps or unnecessary bends, arranged to conform to the building requirements, and to suit clearance for other mechanical work such as ducts, flues, conduits, and other work. No piping shall be installed so as to cause unusual noise from the flow of water therein under normal conditions.

B. Provide manufactured water hammer arrestors, sized and installed in accordance with Plumbing and Drainage Institute Standard PDI WH201.

1. Locate water hammer arrestors at every plumbing fixture, or, where fixtures are located in groups, at every group of fixtures, and as indicated on Drawings.
2. Install water hammer arresters above accessible ceilings, or install access doors for service.

C. In freezing locations arrange water piping to drain as shown.

D. Install piping on room side of building insulation.

E. Check final location of rubber rings within couplings on PVC water piping with gauge or as recommended by manufacturer. Make connection to valves with cast iron adapters connected to water pipe with cast iron couplings. Furnish and install anchors or thrust blocks.

F. For all faucets, hose bibbs, or other water outlets delivering industrial hot and/or cold water, provide a sign, permanently mounted, indicating "CAUTION: NON-POTABLE WATER, DO NOT DRINK". Each sign shall be permanently engraved with black uppercase letters on a yellow background. Letters shall be minimum 1-1/4 inch high.

3.3 INSTALLATION OF SANITARY AND STORM DRAINAGE SYSTEMS

A. Sewer Piping: Run all horizontal sanitary drain piping inside of building on a uniform grade of not less than 1/4 inch per foot unless otherwise noted or later approved. Unless otherwise noted on the plans, piping shall have invert elevations as shown and slope uniformly between given elevations.

B. Storm Drain Piping: Run all horizontal storm drain piping inside of building on a uniform grade of not less than 1/4 inch per foot. Unless otherwise noted on the plans, piping shall have invert elevations as shown and slope uniformly between given elevations.

C. Run all drainage piping as straight as possible and provide easy bends with long turns; make all offsets at an angle of 45 degrees or less.

D. Grade all vent piping so as to free itself quickly of any water condensation.

E. Where possible, join groups of vent risers together with one enlarged outlet through roof. Maintain minimum of 10 foot horizontal or 3 foot vertical clearance from air intakes.

F. Hubless Cast Iron Joints: Comply with coupling manufacturer's installation instructions.

3.4 PIPE JOINTS AND CONNECTIONS

A. General:

1. Cutting: Cut pipe and tubing square, remove rough edges or burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt and debris from inside and outside of pipe before assembly.
3. Boss or saddle type fittings or mechanically extracted tube joints will not be allowed.

B. Threaded Pipe: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply thread compound to external pipe threads: Rectorseal No. 5, Permatex No. 1, or equal.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

C. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

D. Copper Pipe and Tubing (Except pneumatic control piping): All joints shall be brazed according to ASME Section IX, Welding and Brazing Qualifications, except domestic water piping 1-1/4 inches and smaller when not buried in the ground or concrete and type DWV plumbing piping may be soldered.

1. Soldered joints: Apply water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828.

E. Cast Iron Soil Pipe:

1. No-Hub fittings shall be made with a torque wrench.
2. Hub joints shall be with Ty-Seal couplings.
3. Wrought iron, steel, or copper pipe shall have a ring or part of a coupling screwed on to form a spigot end if caulked into a joint.
4. Connect cast iron sewer piping to outside service pipe with cast iron or vitrified LOP reducers or increasers as required. Caulking of smaller pipe into the larger without a reducer or increaser will not be permitted.

F. Flexible Connections:

1. Furnish and install Thermo Tech., Inc. F/J/R, Metraflex, or equal, flexible couplings with limiter bolts on piping connections to all equipment mounted on anti-vibration bases, on each connection to each base mounted pump and where shown. Couplings shall be suitable for pressure and type of service.
2. Anchor piping securely on the system side of each flexible connection.

3.5 INSTALLATION OF VALVES

A. Install valves as indicated on Drawings and in the following locations:

1. Shutoff Valves: Install on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated.
2. Drain Valves: Install on each plumbing equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere indicated or required to completely drain potable water system.
3. Provide gate or globe valves on inlet and outlet of each water heater or pump.

B. General:

1. Valves shall be full line size unless indicated otherwise on Drawings.
2. Install horizontal valves with valve stem above horizontal, except butterfly valves.
3. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
4. Locate valves for easy access and provide separate support where necessary.
5. Install valves in position to allow full stem movement.
6. Install exposed polished or enameled connections with special care showing no tool marks or exposed threads.
7. Butterfly valves conforming to the paragraph “Butterfly Valves” may be used in lieu of gate or globe valves for locations above grade.
8. Ball valves conforming to the paragraph “Ball Valves” may be used in lieu of gate valves for locations above grade for services 2-1/2 inches and smaller.
9. Valves 2-1/2 inches and smaller (except ball valves) in nonferrous water piping systems may be solder joint type with bronze body and trim.

10. Rigidly fasten hose bibbs, hydrants, fixture stops, compressed air outlets, and similar items to the building construction.

C. Gate Valves:

1. Furnish valves in copper lines with adapters to suit valve / line requirements.
2. Underground gate valves:

a. Underground valves 3 inches and smaller may be furnished with operating nuts or hand-wheels, and with Ring-Tite joint ends.
b. Furnish and deliver to Owner one wrench of each size required for operating underground valves.

D. Swing Check Valves: Install in horizontal position with hinge pin level.

E. Butterfly Valves: Install with stems horizontal.

F. Silent Check Valves: Install in horizontal or vertical position between flanges.

G. Calibrated Balancing Valves: Install calibrated balancing valves per manufacturers' recommendations, including requirements for straight pipe lengths at valve inlet and outlet.

H. Valve Adjustment: Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.6 INSTALLATION OF CLEANOUTS

A. Cleanouts: Install in piping as indicated, as required by California Plumbing Code, at each change in direction of piping greater than 45 degrees. Install at maximum intervals of 50 feet for piping 4 inches and smaller and 100 feet for larger piping inside buildings, and at base of each conductor.

B. Flashing Flanges: Install flashing flange and clamping device with each cleanout passing through water resistant membrane.

3.7 INSTALLATION OF FLOOR DRAINS AND FLOOR SINKS

A. Install drains in accordance with manufacturer's written instructions and in locations indicated. Install floor drains with lip of drain slightly below finished floor to ensure drainage. Install floor sinks flush with finished floor. Coordinate with other trades to ensure that floor slopes to drain. Provide flashing flange and clamping device with each drain passing through water resistant membrane.

B. Install vented P-trap below each drain. Where trap primers are indicated, install trap primer connection in the P-trap.

3.8 INSTALLATION OF HOPPER DRAINS

A. Install hopper drain in wall, in sheet metal box, with access door.

1. Size access door and box to suit the size required for hopper drain and trap primer, and solder all seams of box. Seal all penetrations to box with non-hardening waterproof sealant. Provide locking door in occupied spaces.

B. Grind top and sides of funnel, if required, to suit wall thickness.

3.9 TRAP PRIMER INSTALLATION

A. Install as indicated in manufacturers printed literature, with 1/2 inch, Type L, hard copper piping to trap primer connection on floor drains and floor sinks where indicated on Drawings. At Contractor's option, Type K annealed copper tubing without joints may be used be used below slab only. See Section 22 00 50 for pipe protection requirements for below slab copper piping/tubing.

B. Install trap primer piping with 1/4 inch per foot slope, to insure that the line will drain fully to the floor drain or floor sink.

1. Provide ball valve to the inlet at each trap primer location.

C. Install trap primer and distribution unit exactly as called for in manufacturers printed installation instructions. Connect to domestic water piping from the top of the water line, in order to prevent foreign material from entering directly into primer assembly.

D. Mount trap primer in wall, in sheet metal box, with Karp or equal access door. Size access door and box to suit valve operation, and solder all seams of box. Seal all penetrations to box with non-hardening waterproof sealant. Provide locking door where installed in occupied spaces.

E. Where one trap primer will be used for more than one trap, provide a distribution unit with feeder piping for a maximum of four traps sized for equal pressure drop to each trap.

3.10 EQUIPMENT CONNECTIONS

A. Piping Runouts to Fixtures: Provide hot and cold water piping runouts to fixtures of sizes indicated.

B. Mechanical Equipment Connections: Connect hot and cold water piping system and gas piping system to mechanical equipment as indicated, and provide with shutoff valve and union for each connection.

3.11 LABORATORY EQUIPMENT AND CASEWORK INSTALLATION

A. Coordinate all work with Specification Section for Laboratory Equipment and Casework.

B. Furnish and install all required P-traps. Traps shall be Enfield, Fuseal, or equal.

C. Provide stops on all hot and cold water lines at equipment in an accessible position.

D. Seal floor openings watertight.

E. Provide approved vacuum breaker or anti-siphon device on water lines to equipment wherever required.

F. All horizontal piping lines connected to equipment shall be run at the highest possible elevation not less than 6 inches above floor. Piping rough-in shall be stubbed in walls wherever possible.

G. Vent piping for waste lines shall be concealed and vents for island or freestanding equipment shall be looped.

3.12 DOMESTIC WATER SYSTEM STERILIZATION

A. Clean and disinfect new or altered hot and cold water piping connected to domestic water systems using methods prescribed by the Health Authority. If the Health Authority does not prescribe methods, clean and disinfect new or altered hot and cold water piping using methods given in the California Plumbing Code.

1. A water treatment company that has a current state EPA license to apply disinfectant chlorine in potable water shall perform the procedure.

3.13 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect. At completion, carefully clean and adjust equipment, fixtures, and trim that are installed as part of this work. Remove labels from stainless steel sinks, except 316 stainless steel sink labels should be retained to confirm that the correct material has been provided. Leave systems and equipment in satisfactory operating condition.

3.14 OPERATIONAL TESTS

A. Test each piece of equipment to show that it will operate in accordance with indicated requirements.

3.15 TESTING AND BALANCING

A. See Section 23 05 93 of Specifications for testing and balancing requirements.

3.16 CLEANING UP

A. Upon completion of Work remove materials, equipment, apparatus, tools, and the like, and leave premises clean, neat, and orderly.

END OF SECTION 22 10 00

SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Water supplies and stops.
2. Plumbing fixture hangers and supports.

1.2 RELATED REQUIREMENTS

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

B. Section 22 00 50 Basic Plumbing Materials and Methods.

1.3 ACTION SUBMITTALS

A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.

B. Product Data: Submit manufacturer's specifications for plumbing fixtures and trim, including catalog cut of each fixture type and trim item furnished.

1.4 INFORMATIONAL SUBMITTALS

A. Refer to Section 22 00 50, Basic Plumbing Materials and Methods.

1.5 CLOSEOUT SUBMITTALS

A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.

B. Maintenance Data: Submit maintenance data and parts lists for each fixture type and trim item, including instructions for care of finishes. Include this data in Operation and Maintenance Manual.

1.6 QUALITY ASSURANCE

A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.

B. Plumbing Fixture Standards: Comply with applicable portions of the following codes and requirements for all work in this Section:

1. California Building Code – CBC
2. California Plumbing Code – CPC
3. California Health and Safety Code
4. American National Standards Institute - ANSI
5. Federal Standards - F.S.
6. National Sanitary Foundation – NSF International

C. ANSI Standards: Comply with ANSI/NSF 61, “Drinking Water System Components – Health Effects.”

D. PDI Compliance: Comply with standards established by Plumbing and Drainage Institute pertaining to plumbing fixture supports.

E. Americans with Disabilities Act (ADA).

F. California Green Building Standards Code Requirements:

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES

A. General: Provide factory fabricated fixtures of type, style and material indicated. For each type fixture, provide fixture manufacturer's standard trim, carrier, seats, and valves as indicated by their published product information; either as designed and constructed, or as recommended by the manufacturer, and as required for a complete, installation. Where more than one type is dedicated, selection is Contractor's option; but, all fixtures of same type must be furnished by single manufacturer.

1. Take special care with the roughing-in and finished plumbing where batteries of fixtures occur.
2. Take location and mounting heights for roughing-in from Architectural Drawings.
3. Follow schedule on Plumbing Drawings for roughing-in connections. Set roughing-in for all fixtures exactly as per measurements furnished by the manufacturers of the fixtures used.
4. Roughing-in for lavatories and sinks shall be brought in through the wall under the centerline of the drain from the fixture wherever possible and as close to the fixture as possible.

2.2 MATERIALS

A. Provide materials that have been selected for their surface flatness and smoothness. Exposed surfaces that exhibit pitting, seam marks, roller marks, foundry sand holes, stains, discoloration, or other surface imperfections on finished units are not acceptable.

B. Where fittings, trim and accessories are exposed or semi-exposed, provide, chromium plated 17 gauge seamless brass and match faucets and fittings. Provide 17 gauge seamless copper or brass where not exposed.

C. Handles on all faucets and stops shall be all metal chromium plated.

D. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.

2.3 PLUMBING FITTINGS, TRIM AND ACCESSORIES

A. Water Outlets: At locations where water is supplied (by manual, automatic or remote control), provide commercial quality faucets, valves, or dispensing devices, of type and size indicated, and as required to operate as indicated.

1. Include manual shutoff valves and connecting stem pipes to permit outlet servicing without shut-down of water supply piping systems.

B. P-Traps: Include IAPMO approved removable P-traps where drains are indicated for direct connection to drainage system. P-Traps shall be less trap screw cleanout, and incorporate a chrome plated cast brass body, brass connection nuts, 17 gauge seamless brass wall return and chrome plated wall escutcheon to match trap finish.

C. Carriers: Provide cast iron supports for fixtures of graphitic gray iron, ductile iron, or malleable iron as indicated. Where the carrier for wall mounted water closets are installed more than 6 inches behind the finished wall, provide water closet support for wide pipe chase.

D. Fixture Bolt Caps: Provide manufacturer's standard exposed fixture bolt caps finished to match fixture finish.

E. Escutcheons: Where fixture supplies and drains penetrate walls in exposed location, provide chrome-plated cast brass escutcheons with setscrews.

F. Aerators: Provide aerators of types approved by Health Departments having jurisdiction. Delete aerators where not allowed by CPC for health care occupancies.

G. Comply with additional fixture requirements contained in Fixture Schedule shown on the drawings.

2.4 MANUFACTURERS

A. In accordance with California Plumbing Code, provide indelibly marked or embossed manufacturers name or logo, arranged so as to be visible after installation.

B. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following:

1. Vitrified China Plumbing Fixtures:

    a. American Standard, U.S. Plumbing Products.
    b. Eljer Plumbingware Div., Wallace-Murray Corp.
    c. Kohler Co.
    d. VitrA.

2. Modular Lavatories:

    a. Bradley.
    b. Acorn.
    c. Willoughby Industries, Inc.

3. Plumbing Trim:

    a. McGuire Manufacturing Co., Inc.
    b. Delta Commercial.
    c. Chicago Faucet Co.
    d. T&S Brass and Bronze Works, Inc.

4. Flush Valves:

    a. Sloan Valve Co.
    b. Zurn Industries, Hydromechanics Div.
    c. Toto USA, Inc.

5. Faucets:

    a. Chicago Faucet Co.
    b. Symmons Scott.
    c. T&S Brass and Bronze Works, Inc.
    d. Delta Commercial.

6. Fixture Seats:

    a. Church Seat Co.
    b. Bemis Mfg. Co.
    c. Beneke Corp.

7. Stainless Steel Sinks:

    a. Elkay Mfg. Co.
    b. Just Mfg. Co.
    c. Haws Corporation.

8. Fixture Carriers:

    a. Josam Mfg. Co.
    b. J. R. Smith.
    c. Tyler Pipe; Wade Div.

d. Zurn Industries; Hydromechanics Div.
e. Mifab, Inc.

2.5 FLUSH VALVE REQUIREMENTS

A. Metering flush valves where required and specified shall be non-hold open type with exposed parts chrome plated. Conform to all codes and manufacturers' recommendations. All diaphragms are to have multiple filtered bypass and be chloramine resistant synthetic rubber with internal components suitable for l80 degree hot water to l50 pounds pressure, plastic or leather diaphragm not acceptable.

B. Electronic flush valves where required and specified shall be non-hold open type with exposed parts chrome plated. Conform to all codes and manufacturers' recommendations. All diaphragms are to have multiple filtered by pass and be chloramine and resistant synthetic rubber with rubber and internal components suitable for 180 degree hot water to 150 pounds pressure, plastic or leather diaphragm not acceptable. All flush valve solenoids and sensors shall be UL listed.

2.6 FIXTURE CONNECTIONS

A. Make connection between fixtures and flanges on soil pipe absolutely gastight and watertight with neoprene type gaskets (wall hung fixtures) or bowl wax (floor outlet fixtures). Rubber gaskets or putty will not be permitted.

B. Provide fixtures not having integral traps with P-traps of chromium-plated 17 gauge cast brass, with 17 gauge seamless brass wall return, connected to concealed waste in wall and sanitary fittings. Provide IAPMO approval for trap, and provide less trap screw cleanout.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Dearborn Brass, Commercial series with brass nuts.
b. Delta Commercial.
c. McGuire Manufacturing Co., Inc.

C. Connections from stacks or horizontal wastes to wall or floor finish for wastes from lavatories, urinals, sinks, and drinking fountains and connection between floor drains and traps shall be IPS 85 percent red brass pipe.

D. Plumbing fixture traps connected to special waste systems shall be constructed of materials to suit the waste system.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Orion.

b. Enfield

E. Unions on waste pipes on fixture side of traps may be slip or flange joints with soft rubber or lead gaskets. Traps shall rough in full size to waste and vent connection, using deep escutcheon plate to cover wall penetration. Compression adaptor extensions or sweat adaptors are not acceptable.

2.7 WATER SUPPLIES AND STOPS

A. Provide 85 percent IPS threaded red brass nipple, conforming to the lead-free requirements of California Health and Safety Code Section 11 68 75, securely anchored to building construction, for each connection to stops, hose bibbs, etc. Each fixture, except hose bibbs, shall have stop valves installed on water supply lines.

B. Provide water supplies to fixtures with compression shut-off stops with threaded inlets and lock shield-loose key handles. Provide combination fixtures with compression stop and threaded inlet on each water supply fitting. Provide lock shield-loose key handle for each stop.

C. Provide 1/2 inch riser tubes with reducing coupling for fixtures, unless otherwise noted.

D. Provide cast brass escutcheon.

E. Furnish shut-off valves on hose bibbs where directly connected to mains with no intervening valves.

F. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. McGuire Manufacturing Company, Inc., model LFH2167LK.
2. T & S Brass and Bronze Works, Inc., model B-1305.

2.8 PLUMBING FIXTURE HANGERS AND SUPPORTS

A. Floor-affixed supports for off-the-floor plumbing fixtures shall comply with ASME A112.6.1M.

B. Residential type fixture supports are not acceptable.

C. Install wall mounted water closets with combination support and waste fittings, with feet of support securely anchored to floor.

D. Install floor mounted water closets with J.R. Smith, Zurn, or equal government pattern cast iron closet flanges with brass bolts, nuts, washers, and porcelain caps secured with Spackle.

E. Install the following fixtures on concealed support with feet of support securely anchored to floor. Anchor top of support to wall construction in an approved manner.

1. Wall hung lavatories.

2. Wall mounted urinals.
3. Drinking fountains.
4. Electric water coolers.

2.9 PLUMBING FIXTURES

A. Install all plumbing fixtures at height indicated on Architectural Drawings. Where mounting height is not indicated, install at height required by Code.

B. Special Requirements For Accessible Fixtures:

1. Operating handle or valve for accessible water closets, urinals, lavatories, and sinks shall operate with less than 5 pounds force. Metering faucets shall be adjusted to operate between 10 and 15 seconds.
2. Insulate exposed waste piping and domestic water supplies below accessible fixtures with CBC access code compliant molded “closed-cell” vinyl covers. Covers shall be installed using vandal resistant fasteners and must be removable. Covers shall meet flame spread rating not to exceed 25 and smoke density not to exceed 50 when tested in accordance with ASTM E-84, and shall comply with the requirements of California Code of Regulations, Title 24. Plumberex – Handy Shield, Johns Manville – Zeston 2000, or equal.

PART 3 - EXECUTION

3.1 PRODUCT HANDLING AND PROTECTION

A. Deliver packaged materials in their original, unopened wrapping with labels intact. Protect materials from water, the elements and other damage during delivery, storage and handling.

3.2 PREPARATORY PROVISIONS

A. The Contractor is responsible for the examination and acceptance of all conditions affecting the proper construction and/or installation of the Work of this Section. Do not proceed until all unsatisfactory conditions have been corrected. Commencing work will be construed as acceptance of all conditions by the Contractor as satisfactory for the construction and/or installation of the Work.

3.3 INSPECTION AND PREPARATION

A. Examine roughing-in work of domestic water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors and substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping, and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Install plumbing fixtures of types indicated where shown and at indicated heights; in accordance with fixture manufacturer's written instructions, roughing-in drawings. Ensure that plumbing fixtures comply with requirements and serve intended purposes. Comply with applicable requirements of the National Standard Plumbing Code pertaining to installation of plumbing fixtures.

C. Fasten plumbing fixtures securely to supports or building structure; and ensure that fixtures are level and plumb. Secure plumbing supplies to blocking behind or within wall construction so as to be rigid, and not subject to pull or push movement.

D. Install CBC accessible fixtures in accordance with Chapter 4 California Plumbing Code, and Chapters 11A and 11B California Building Code.

E. Refer to Division 26 for wiring for electronic flush valves.

3.4 FAUCET INSTALLATION

A. Provide 85 percent IPS red brass pipe, conforming to lead-free requirements of California Health and Safety Code Section 11 68 75, securely anchored to building construction, for each connection to faucets, stops, hose bibbs, etc. Each fixture, except hose bibbs, shall have a stop valve installed on water supply lines to permit repairs without shutting off water mains.

B. Adjust metering faucets to run for 10 to 15 seconds.

3.5 CLEAN AND PROTECT

A. Clean plumbing fixtures of dirt and debris upon completion of installation.

B. Protect installed fixtures from damage during the remainder of the construction period.

C. Grout voids between all fixtures and adjacent surfaces with white Dow Silicone Sealant, arranged to shed water.

3.6 FIELD QUALITY CONTROL

A. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

3.7 EXTRA STOCK

A. General: Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner with receipt. Furnish one device for every ten units.

END OF SECTION 22 40 00

SECTION 23 00 50 - BASIC HVAC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Access Doors.
2. Flexible joints.

1.2 RELATED REQUIREMENTS

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

B. This Section is a part of each Division 23 Section.

1.3 ADDITIONAL REQUIREMENTS

A. Furnish and install incidental work not shown or specified necessary to provide a complete and workable system.

B. Make all temporary connections required to maintain services, including adequate heat and cooling, during the course of the Contract without additional cost to Owner. Notify Owner seven days in advance before disrupting services.

C. Provide for adjustments or modifications to fan and motor sheaves, belts, damper linkages, and other components as required to achieve specified air balance at no additional cost to Owner.

1.4 REFERENCES AND STANDARDS

A. Where material or equipment is specified to conform to referenced standards, it shall be assumed that the most recent edition of the standard in effect at the time of bid shall be used.

1. AABC - Associated Air Balance Council
2. AFBMA - Anti Friction Bearing Manufacturer's Association
3. AMCA - Air Moving and Control Association Inc.

    a. Standard 210 - Laboratory Methods of Testing Fans

4. ANSI - American National Standards Institute
5. ARI - Air-Conditioning and Refrigeration Institute

6. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers
7. ASME - American Society of Mechanical Engineers
8. ASTM - American Society for Testing and Materials
9. CCR - California Code of Regulations

    a. Title 8 - Division of Industrial Safety, Subchapter 7; General Industry Safety Orders, Articles 31 through 36

10. CSA – Canadian Standards Association International
11. CSFM - California State Fire Marshal
12. NCPWB - National Certified Pipe Welding Bureau
13. NIST - National Institute of Standards and Technology
14. NEMA - National Electrical Manufacturers' Association
15. NFPA - National Fire Protection Association
16. OSHA - Occupational Safety and Health Act
17. SMACNA - Duct Manuals
18. UL - Underwriters' Laboratories, Inc.

B. Requirements of Regulatory Agencies:

1. The publications listed below form part of this specification; comply with provisions of these publications except as otherwise shown or specified.

    a. California Building Code, 2022.
    b. California Electrical Code, 2022.
    c. California Energy Code, 2022.
    d. California Fire Code, 2022.
    e. California Green Building Standards Code, 2022.
    f. California Mechanical Code, 2022.
    g. California Plumbing Code, 2022.
    h. California Code of Regulations, Title 24.
    i. California Health and Safety Code.
    j. CAL-OSHA.
    k. California State Fire Marshal, Title 19 CCR.
    l. National Fire Protection Association.
    m. Occupational Safety and Health Administration.
    n. Other applicable state laws.

2. Nothing in Drawings or specifications shall be construed to permit work not conforming to these codes, or to requirements of authorities having jurisdiction. It is not the intent of Drawings or specifications to repeat requirements of codes except where necessary for clarity.

1.5 DRAWINGS

A. Examine Drawings prior to bidding of work and report discrepancies in writing to Architect.

B. Drawings showing location of equipment and materials are diagrammatic and job conditions will not always permit installation in location shown. The HVAC Drawings show general arrangement of equipment and materials, etc., and shall be followed as closely as existing conditions, actual building construction, and work of other trades permit.

1. Architectural and Structural Drawings shall be considered part of the Work. These Drawings furnish Contractor with information relating to design and construction of the Project. Architectural Drawings take precedence over HVAC Drawings.
2. Because of the small scale of HVAC Drawings, not all offsets, fittings, and accessories required are shown. Investigate structural and finish conditions affecting the Work and arrange Work accordingly. Provide offsets, fittings, and accessories required to meet conditions. Inform Architect immediately when job conditions do not permit installation of equipment and materials in the locations shown. Obtain the Architects approval prior to relocation of equipment and materials.
3. Relocate equipment and materials installed without prior approval of the Architect. Remove and relocate equipment and materials at Contactors' expense upon Architects' direction.
4. Minor changes in locations of equipment, piping, ducts, etc., from locations shown shall be made when directed by the Architect at no additional cost to the Owner providing such change is ordered before such items of work, or work directly connected to same are installed and providing no additional material is required.

C. Execute work mentioned in the Specifications and not shown on the Drawings, or vice versa, the same as if specifically mentioned or shown in both.

1.6 FEES AND PERMITS

A. Obtain and pay for permits and service required in installation of the Work. Arrange for required inspections and secure approvals from authorities having jurisdiction. Comply with requirements of Division 01.

B. Arrange for utility connections and pay charges incurred, including excess service charges.

C. Coordination:

1. General:

a. Coordinate HVAC Work with trades covered in other Specifications Sections to provide a complete, operable and sanitary installation of the highest quality workmanship.

2. Electrical Coordination:

a. Refer to the Electrical Drawings and Specifications, Division 26, for service voltage and power feed wiring for equipment specified under this section. Contractor has full responsibility for the following items of work:

1) Review the Electrical Drawings and Division 26 Specifications to verify that electrical services provided are adequate and compatible with equipment requirements.
2) If additional electrical services are required above that indicated on Electrical Drawings and in Division 26, such as more control interlock conductors, larger feeder, or separate 120 volt control power source, include cost to furnish and install additional electrical services as part of the bid.
3) Prior to proceeding with installation of additional electrical work, submit detailed drawings indicating exact scope of additional electrical work.

3. Mechanical Coordination:

a. Arrange for pipe spaces, chases, slots and openings in building structure during progress of construction, to accommodate mechanical system installation.
b. Coordinate installation of supporting devices. Set sleeves in poured-in-place concrete and other structural components during construction.
c. Coordinate requirements for access panels and doors for mechanical items requiring access where concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section “Access Doors and Frames.”
d. Coordinate with other trades equipment locations, pipe, duct and conduit runs, electrical outlets and fixtures, air inlets and outlets, and structural and architectural features. Provide information on location of piping and seismic bracing to other trades as required for a completely coordinated project.

1.7 SUBMITTALS - GENERAL

A. Refer to Division 01 Submittals Section(s) for additional requirements.

B. Submittal packages may be submitted via email as PDF electronic files, or as printed packages. PDFs shall be legible at actual size (100 percent). Provide seven copies of printed submittal packages.

C. Provide submittal of materials proposed for use as part of this Project. Product names in Specifications and on Drawings are used as standards of quality. Furnish standard items on specified equipment at no extra cost to the Contract regardless of disposition of submittal data. Other materials or methods shall not be used unless approved in writing by Architect. Architect's review will be required even though "or equal" or synonymous terms are used.

1. Partial or incomplete submittals will not be considered.
2. Quantities are Contractor's responsibility and will not be reviewed.
3. Provide materials of the same brand or manufacturer for each class of equipment or material.
4. Identify each item by manufacturer, brand, trade name, number, size, rating, or other data necessary to properly identify and review materials and equipment. Words "as specified" are not sufficient identification.
5. Identify each submittal item by reference to items’ Specification Section number and paragraph, by Drawing and detail number, and by unit tag number.
6. Organize submittals in same sequence as in Specification Sections.

7. Show physical arrangement, construction details, finishes, materials used in fabrications, provisions for piping entrance, access requirements for installation and maintenance, physical size, mechanical characteristics, foundation and support details, and weight.

    a. Submit Shop Drawings, performance curves, and other pertinent data, showing size and capacity of proposed materials.
    b. Specifically indicate, by drawn detail or note, that equipment complies with each specifically stated requirement of Contract Documents.
    c. Drawings shall be drawn to scale and dimensioned (except schematic diagrams). Drawings may be prepared by vendor but must be submitted as instruments of Contractor, thoroughly checked and signed by Contractor before submission to Architect for review.
    d. Catalog cuts and published material may be included with supplemental scaled drawings.

D. Review of submittals will be only for general conformance with design concept and general compliance with information given in Contract Documents. Review will not include quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with work of other trades, or construction safety precautions, which are sole responsibility of Contractor. Review of a component of an assembly does not indicate acceptance of an assembly. Deviations from Contract Documents not clearly identified by Contractor are Contractor's responsibility and will not be reviewed by Architect.

E. Within reasonable time after award of contract and in ample time to avoid delay of construction, submit to Architect shop drawings or submittals on all items of equipment and materials provided. Provide submittal as a complete package.

1. Shop drawings and submittals shall include Specification Section, Paragraph number, and Drawing unit symbol or detail number for reference. Organize submittals into booklets for each Specification section and submit in loose-leaf binders with index. Deviations from the Contract Documents shall be prominently displayed in the front of the submittal package and referenced to the applicable Contract requirement.

F. Furnish to the Project Inspector complete installation instructions on material and equipment before starting installation.

1.8 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for plumbing systems materials and products.

B. Shop Drawings.

C. Sustainable Design Submittals:

1. Product Data: For adhesives and sealants, documentation of compliance including printed statement of VOC content and chemical components.

2. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.

1.9 INFORMATIONAL SUBMITTALS

A. Provide coordinated layouts for HVAC Ductwork systems, in accordance with Specification Section 23 80 00.

B. Provide evidence of equipment certification to California Energy Code Section 110.1 or 110.2, if not providing Electrically Commutated motors for HVAC fans sized below 1 hp and above 1/12 hp. Refer to specific equipment articles requiring electrically commutated motors.

C. Check, Test, and Start forms, from equipment manufacturers.

D. Check, Test and Start reports.

1.10 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Furnish three complete sets of Operation and Maintenance Manual bound in hardboard binder, and one compact disc containing complete Operation and Maintenance Manual in searchable PDF format. Provide Table of Contents. Provide index tabs for each piece of equipment in binder and disc. Begin compiling data upon approval of submittals.

    a. Sets shall incorporate the following:

        1) Product Data.
        2) Shop Drawings.
        3) Record Drawings.
        4) Service telephone number, address and contact person for each category of equipment or system.
        5) Complete operating instructions for each item of heating, ventilating and air conditioning equipment.
        6) Copies of guarantees/warrantees for each item of equipment or systems.
        7) Test data and system balancing reports.
        8) Typewritten maintenance instructions for each item of equipment listing lubricants to be used, frequency of lubrication, inspections required, adjustment, etc.
        9) Manufacturers' bulletins with parts numbers, instructions, etc., for each item of equipment.
        10) Temperature control diagrams and literature.
        11) Check test and start reports for each piece of mechanical equipment provided as part of the Work.
        12) Commissioning and Preliminary Operation Tests required as part of the Work.

2. Post service telephone numbers and addresses in an appropriate place designated by Architect.

B. Record Drawings:

1. Refer to Division 01 for additional requirements.
2. Upon completion of the Work, deliver to Architect the following:

a. Originals of drawings showing the Work exactly as installed.
b. One complete set of reproducible drawings showing the Work exactly as installed.
c. One compact disc with complete set of drawings in PDF format showing the Work exactly as installed.
d. Provide Contractor's signature, verifying accuracy of record drawings.
e. Obtain the signature of the Inspector of Record for Record Drawings.

1.11 SUBSTITUTIONS

A. Refer to Division 01 for complete instructions. Requirements given below are in addition to or are intended to amplify Division 01 requirements. In case of conflict between requirements given herein and those of Division 01, Division 01 requirements shall apply.

B. It is the responsibility of Contractor to assume costs incurred because of additional work and or changes required to incorporate proposed substitute into the Project. Refer to Division 01 for complete instructions.

C. Substitutions will be interpreted to be manufacturers other than those specifically listed in the Contract Documents by brand name, model, or catalog number.

D. Only one request for substitution will be considered for each item of equipment or material.

E. Substitution requests shall include the following:

1. Reason for substitution request.
2. Complete submittal information as described herein; see "Submittals."
3. Coordinated scale layout drawings depicting position of substituted equipment in relation to other work, with required clearances for operation, maintenance and replacement.
4. List optional features required for substituted equipment to meet functional requirements of the system as indicated in Contract Documents.
5. Explanation of impact on connected utilities.
6. Explanation of impact on structural supports.

F. Installation of reviewed substitution is Contractors' responsibility. Any mechanical, electrical, structural, or other changes required for installation of substituted equipment or material must be made by Contractor without additional cost to Owner. Review by Architect of substituted equipment or material, will not waive these requirements.

G. Contractor may be required to compensate Architect for costs related to substituted equipment or material.

1.12 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of HVAC systems products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Contractor's Qualifications: Firm with at least 5 years of successful installation experience on projects with HVAC systems work similar to that required for this Project.

C. Comply with applicable portions of California Mechanical Code pertaining to selection and installation of HVAC materials and products.

D. All materials and products shall be new.

1.13 DELIVERY, STORAGE, AND HANDLING

A. Protect equipment and materials delivered to Project site from weather, humidity and temperature variations, dirt, dust and other contaminants.

1.14 FIELD CONDITIONS

A. Contractor shall visit Project site and examine existing conditions in order to become familiar with Project scope. Verify dimensions shown on Drawings at Project site. Bring discrepancies to the attention of Architect. Failure to examine Project site shall not constitute basis for claims for additional work because of lack of knowledge or location of hidden conditions that affect Project scope.

B. Information on Drawings relative to existing conditions is approximate. Deviations from Drawings necessary during progress of construction to conform to actual conditions shall be approved by the Architect and shall be made without additional cost to the Owner. The Contractor shall be held responsible for damage caused to existing services. Promptly notify the Architect if services are found which are not shown on Drawings.

1.15 WARRANTY

A. Refer to Division 01 for warranty requirements, and duration and effective date of Contractor’s Standard Guarantee.

B. Repair or replace defective work, material, or part that appears within the warranty period, including damage caused by leaks.

C. On failure to comply with warranty requirements within a reasonable length of time after notification is given, Architect/Owner shall have repairs made at Contractor's expense.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials or equipment of the same type shall be of the same brand wherever possible. All materials shall be new and in first class condition.

B. All sizes, capacities, and efficiency ratings shown are minimum, except that gas capacity is maximum available.

C. Refer to Division 22 10 00 and 23 80 00 for specific system piping materials.

2.2 MATERIALS

A. No material installed as part of this Work shall contain asbestos.

B. California Green Building Code Compliance:

1. HVAC and refrigeration equipment shall not contain CFCs.
2. HVAC and refrigeration equipment shall not contain Halons.

2.3 ACCESS DOORS

A. Where floors, walls, or ceilings must be penetrated for access to mechanical equipment, provide access doors, 14 inch by 14 inch minimum size in usable opening. Where entrance of a serviceman may be required, provide 20 inch by 30 inch minimum usable opening. Locate access doors/panels for non-obstructed and easy reach.

1. All access doors less than 7'-0" above floors and exposed to public access shall have keyed locks.

B. Access doors shall match those supplied in Division 08 in all respects, except as noted herein.

C. Provide stainless steel access doors for use in toilet rooms, shower rooms, kitchens and other damp areas. Provide steel access doors with prime coat of baked-on paint for all other areas.

D. Where panels are located on ducts or plenums, provide neoprene gaskets to prevent air leakage, and use frames to set door out to flush with insulation.

E. Provide insulated doors where located in internally insulated ducts or casings.

F. Do not locate access doors in highly visible public areas such as lobbies, waiting areas, and primary entrance areas. Coordinate with the Architect when access is required in these areas.

G. Where specific information or details relating to access panels different from the above is shown or given on the Drawings or other Divisions of work, then that information shall supersede this specification.

H. Manufacturers: Subject to compliance with requirements, available manufacturers offering products which may be incorporated into the Work include Milcor, Karp, Nystrom, or Cesco, equal to the following:

1. Milcor

a. Style K (plaster).
b. Style DW (gypsum board).
c. Style M (Masonry).
d. Style "Fire Rated" where required.

2.4 FLEXIBLE JOINTS

A. Where indicated on Drawings, provide Metraflex Metrasphere, Style R, Mason Industries, or equal, Spherical Expansion Joints. Provide control units at each expansion joint, arranged to limit both expansion and compression.

B. Flexible joints at entry points to building shall be Barco Ductile iron, Advanced Thermal Systems, or equal, threaded style with stainless ball and mineral filled seal.

2.5 EQUIPMENT IDENTIFICATION

A. Identify each piece of equipment with a permanently attached engraved bakelite plate, 1/2 inch high white letters on black background.

2.6 PIPE IDENTIFICATION

A. Identify each piping system and indicate the direction of flow by means of Seton, Inc., Marking Services Inc., Reef Industries, Inc., or equal, pre-tensioned, coiled semi-rigid plastic pipe labels formed to circumference of pipe, requiring no fasteners or adhesive for attachment to pipe.

B. The legend and flow arrow shall conform to ASME A13.1.

PART 3 - EXECUTION

3.1 EXISTING MATERIALS:

A. Remove existing equipment, piping, wiring, construction, etc., which interferes with Work of this Contract. Promptly return to service upon completion of work in the area. Replace items damaged by Contractor with new material to match existing.

B. Removed materials which will not be re-installed and which are not claimed by Owner shall become the property of Contractor and shall be removed from the Project site. Consult Owner before removing any material from the Project site. Carefully remove materials claimed by Owner to prevent damage and deliver to Owner-designated storage location.

C. Existing piping and wiring not reused and are concealed in building construction may be abandoned in place and all ends shall be capped or plugged. Remove unused piping and wiring exposed in Equipment Rooms or occupied spaces. Material shall be removed from the premises. Disconnect power, water, gas, pump or any other active energy source from piping or electrical service prior to abandoning in place.

3.2 FRAMING, CUTTING, AND PATCHING

A. Special framing, recesses, chases and backing for Work of this Section, unless otherwise specified, are covered under other Specification Sections.

B. Contractor is responsible for placement of pipe sleeves, hangers, inserts, supports, and location of openings for the Work.

C. Cutting, patching, and repairing of existing construction to permit installation of equipment, and materials is the responsibility of Contractor. Repair or replace damage to existing work with skilled mechanics for each trade.

D. Cut existing concrete construction with a concrete saw. Do not utilize pneumatic devices.

E. Core openings through existing construction for passage of new piping and conduits. Cut holes of minimum diameter to suit size of pipe and associated insulation installed. Coordinate with building structure, and obtain Structural Engineer's approval prior to coring through existing construction.

3.3 MECHANICAL DEMOLITION

A. Refer to Division 01 Sections “Cutting and Patching” and “Selective Demolition” for general demolition requirements and procedures.

B. Disconnect, dismantle and remove mechanical systems, equipment, and components indicated to be removed. Coordinate with all other trades.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping to remain with same or compatible piping material. Refrigerant system must be evacuated per EPA requirements.
3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and cap remaining ducts with same or compatible ductwork material.
4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
5. Equipment to Be Removed: Drain down and cap remaining services and remove equipment.
6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.

7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.4 ELECTRICAL REQUIREMENTS

A. Provide adequate working space around electrical equipment in compliance with the California Electrical Code. Coordinate the Mechanical Work with the Electrical Work to comply.

B. Furnish necessary control diagrams and instructions for the controls. Before permitting operation of any equipment which is furnished, installed, or modified under this Section, review all associated electrical work, including overload protection devices, and assume complete responsibility for the correctness of the electrical connections and protective devices. Motors and control equipment shall conform to the Standards of the National Electrical Manufacturers' Association. All equipment and connections exposed to the weather shall be NEMA IIIR with factory-wired strip heaters in each starter enclosure and temperature control panel where required to inhibit condensation.

C. All line voltage and low voltage wiring and conduit associated with the Temperature Control System are included in this Section. Wiring and conduit shall comply with Division 26.

3.5 PIPING SYSTEM REQUIREMENTS

A. Drawing plans, schematic and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

3.6 PRIMING AND PAINTING

A. Perform priming and painting on the equipment and materials as specified herein.

B. See Division 09 Painting Section(s) for detailed requirements.

C. Priming and painting:

1. Exposed ferrous metals, including piping, which are not galvanized or factory-finished shall be primed and painted.

a. Black Steel Piping:

1) Primer: One coat gray Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, comparable products by Rust-Oleum, Kelly Moore, or equal.
2) Topcoat: Two coats gray Sherwin-Williams Pro Industrial Waterbased Alkyd Urethane Enamel, comparable products by Rust-Oleum, Kelly Moore, or equal.

b. Interior Ductwork: Refer to Division 09 Painting Section(s). Architect shall select paint color.

2. Metal surfaces of items to be jacketed or insulated except ductwork and piping shall be given two coats of primer unless furnished with equivalent factory finish. Items to be primed shall be properly cleaned by effective means free of rust, dirt, scale, grease and other deleterious matter and then primed with the best available grade of zinc rich primer. After erection or installation, all primed surfaces shall be properly cleaned of any foreign or deleterious matter that might impair proper bonding of subsequent paint coatings. Any abrasion or other damage to the shop or field prime coat shall be properly repaired and touched up with the same material used for the original priming.
3. Where equipment is provided with nameplate data, the nameplate shall be masked off prior to painting. When painting is completed, remove masking material.

3.7 UNION AND FLANGE INSTALLATION

A. Install Epco, Nibco, or equal, dielectric unions or flanges at points of connection between copper or brass piping or material and steel or cast iron pipe or material except in drain piping. Bushings or couplings shall not be used.

B. Install unions in piping NPS 2” and smaller 3 or flanges in piping NPS 2-1/2” and larger whether shown or not at each connection to all equipment and tanks, and at all connections to all automatic valves, such as temperature control valves.

C. Locate the unions for easy removal of the equipment, tank, or valve.

D. Do not install unions or flanges in refrigerant piping systems.

3.8 ACCESS DOOR INSTALLATION

A. Furnish and install access doors wherever required whether shown or not for easy maintenance of mechanical systems; for example, at concealed valves, strainers, traps, cleanouts, dampers, motors, controls, operating equipment, etc. Access doors shall provide for complete removal and replacement of equipment.

3.9 CONCRETE WORK

A. Concrete work required for work of this Section shall be included under another section of the Specification, unless otherwise noted, including poured-in-place concrete work for installing precast manholes, catch basins, etc., and shall include reinforced concrete bases for pumps,

tanks, compressors, fan units, boilers, unless the work is specifically indicated on the Drawings to be furnished under this Section.

B. Underground anchors, and pads for valve access boxes are included under this Section of the Specification. Concrete shall be 3000 psi test minimum. Refer to Division 03 for concrete types.

3.10 OPERATION OF SYSTEMS

A. Do not operate any mechanical equipment for any purpose, temporary or permanent, until all of the following has been completed:

1. Complete all requirements listed under “Check, Test and Start Requirements.”
2. Ductwork and piping has been properly cleaned. Piping systems shall be flushed and treated prior to operation.
3. Filters, strainers etc. are in place.
4. Bearings have been lubricated, and alignment of rotating equipment has been checked.
5. Equipment has been run under observation, and is operating in a satisfactory manner.

B. Provide test and balance agency with one set of Contract Drawings, Specifications, Addenda, Change orders issued, applicable shop drawings and submittals and temperature control drawings.

3.11 TEMPORARY HEAT

A. The General Contractor will provide for all temporary heat at such times as may be required or directed by the Architect and pay all fuel and energy costs incurred.

B. Temporary heating facilities proposed for use by the Contractor will be subject to review of the Architect. Prior to use of any equipment for temporary heat, install temporary filters on all return air inlets, to preclude dust and construction debris from entering the duct system. In addition, install filters in air handling units, and replace at the completion of temporary operation.

C. Filters used for temporary operation of systems shall be as specified for permanent filters specified herein.

D. Comply with Check, Test and Start Requirements for start-up of equipment prior to operation for temporary heat.

E. Contractor shall complete the permanent heating system as soon as possible, thereby making it available for temporary heat. When available, the system may be used as required at the direction of the Architect after systems are properly prepared for use as specified elsewhere. Contractor shall then be responsible for operating the system during periods required and the General Contractor shall pay the fuel and energy costs incurred. Operation of the heating system prior to the filing of "notice of completion" shall not change the Guarantee provisions in any way.

3.12 CHECK, TEST AND START REQUIREMENTS

A. An authorized representative of the equipment manufacturer shall perform check, test and start of each piece of mechanical equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the check test and start of the equipment.

1. As part of the submittal process, provide a copy of each manufacturer's printed startup form to be used.
2. Some items of specified equipment may require that check, test and start of equipment must be performed by the manufacturer, using manufacturer's employees. See specific equipment Articles in these Specifications for this requirement.
3. Provide all personnel, test instruments, and equipment to properly perform the check, test and start work.
4. When work has been completed, provide copies of reports for review, prior to final observation of work.

B. Provide copies of the completed check, test and start report of each item of equipment, bound with the Operation and Maintenance Manual.

C. Upon completion of the work, provide a schedule of planned maintenance for each piece of equipment. Indicate frequency of service, recommended spare parts (including filters and lubricants), and methods for adjustment and alignment of all equipment components. Provide a copy of the schedule with each Operation and Maintenance Manual. Provide a copy of certification from the Owner's representative indicating that they have been properly instructed in maintenance requirements for the equipment installed.

3.13 PRELIMINARY OPERATIONAL REQUIREMENTS AND TESTS

A. Prior to observation to determine final acceptance, put HVAC, plumbing, and fire protection systems into service and check that work required for that purpose has been done, including but not limited to the following condensed check list. Provide indexed report to tabulating the results of all work.

1. All equipment has been started, checked, lubricated and adjusted in accordance with the manufacturer's recommendations, including modulating power exhausts if present.
2. Correct rotation of motors and ratings of overload heaters are verified.
3. Specified filters are installed and spare filters have been turned over to Owner.
4. All manufacturers' certificates of start-up specified have been delivered to the Owner.
5. All equipment has been cleaned, and damaged painted finishes touched up.
6. Damaged fins on heat exchangers have been combed out.
7. Missing or damaged parts have been replaced.
8. Flushing and chemical treatment of piping systems has been completed and water treatment equipment, where specified, is in operation.
9. Equipment labels, pipe marker labels, ceiling markers and valve tags are installed.
10. Valve tag schedules, corrected control diagrams, sequence of operation lists and start-stop instructions have been posted.

11. Preliminary test and balance work is complete, and reports have been forwarded for review.
12. Automatic control set points are as designated and performance of controls checks out to agree with the sequence of operation.
13. Operation and Maintenance Manuals have been delivered and instructions to the operating personnel have been made.

B. Prior to the observation to determine final acceptance, operate all mechanical systems as required to demonstrate that the installation and performance of these systems conform to the requirements of these specifications.

1. Operate and test all mechanical equipment and systems for a period of at least five consecutive 8 hour days to demonstrate the satisfactory overall operation of the project as a complete unit.
2. Include operation of heating and air conditioning equipment and systems for a period of not less than two 8 hour days at not less than 90 percent of full specified heating and cooling capacities in tests.
3. Commence tests after preliminary balancing and adjustments to equipment have been checked. Immediately before starting tests, install air filters and lubricate all running equipment. Notify the Architect at least seven calendar days in advance of starting the above tests.
4. During the test period, make final adjustments and balancing of equipment, systems controls, and circuits so that all are placed in first class operating condition.
5. Where Utility District rebates are applicable, demonstrate that the systems meet the rebate program requirements.

C. Before handing over the system to Owner replace all filters with complete new set of filters.

D. Review of Contractor's Tests:

1. All tests made by the Contractor or manufacturers' representatives are subject to observation and review by the Owner. Provide timely notice prior to start of each test, in order to allow for observation of testing. Upon the completion of all tests, provide a letter to confirm that all testing has been successful.

E. Test Logs:

1. Maintain test logs listing the tests on all mechanical systems showing dates, items tested, inspectors' names, remarks on success or failure of the tests.

F. Preliminary Operation:

1. The Owner reserves the right to operate portions of the mechanical system on a preliminary basis without voiding the guarantee.

G. Operational Tests:

1. Before operational tests are performed, demonstrate that all systems and components are complete and fully charged with operating fluid and lubricants.

2. Systems shall be operable and capable of maintaining continuous uninterrupted operation during the operating and demonstration period. After all systems have been completely installed, connections made, and tests completed, operate the systems continuously for a period of five working days during the hours of a normal working day.
3. This period of continuous systems operation may be coordinated with the removal of Volatile Organic Compounds (VOCs) from the building prior to occupancy should the Owner decide to implement such a program.
4. Control systems shall be completely operable with settings properly calibrated and adjusted.
5. Rotating equipment shall be in dynamic balance and alignment.
6. If the system fails to operate continuously during the test period, the deficiencies shall be corrected and the entire test repeated.

H. Pre-Occupancy Building Purge:

1. Prior to occupancy, ventilate the building on 100 percent outside air, 100 percent exhaust for a continuous period determined by a qualified industrial hygienist (engaged by the Contractor) to reduce V.O.C's prior to occupancy.
2. Submit report by the industrial hygienist verifying satisfactory completion of the pre-occupancy purge.

3.14 CERTIFICATES OF INSTALLATION

A. Contractor shall complete applicable "Certificates of Installation" forms contained in the California Building Energy Efficiency Standards and submit to the authorities having jurisdiction for approval and issuance of final occupancy permit, as described in the California Energy Code.

3.15 ACCEPTANCE REQUIREMENTS

A. Contractor shall complete the applicable Acceptance Requirements for Code Compliance contained in the California Building Energy Efficiency Standards. Refer to T-24 compliance forms on Drawings for systems having Acceptance testing requirements. Contractor shall perform Acceptance tests and complete the appropriate "Certificates of Acceptance." Submit certificates to the authorities having jurisdiction for approval and issuance of final occupancy permit. Contractor shall engage certified HERS Rater to verify duct leakage rate for duct systems indicated on T-24 compliance forms on Drawings as requiring duct leakage rate testing. For additional duct leak testing requirements, refer to Section 23 80 00, "Heating, Ventilating, and Air Conditioning," Article, "Ductwork Sealing and Leak Testing."

1. Covered Processes: In addition to systems listed on T-24 compliance forms on Drawings, complete Acceptance Requirements for the following systems, if applicable to Project:

   a. Parking garage ventilation systems.
   b. Compressed air systems.
   c. Type 1 Kitchen exhaust systems.

3.16 DEMONSTRATION AND TRAINING

A. An authorized representative of the equipment manufacturer shall train Owner-designated personnel in maintenance and adjustment of equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the Owner training for the equipment installed.

1. As part of the submittal process, provide a training agenda outlining major topics and time allowed for each topic.
2. Some items of specified equipment require that training must be performed by the manufacturer, using manufacturer's employees. See specific equipment Articles in these Specifications for this requirement.
3. Contractor shall provide three copies of certification by Contractor that training has been completed, signed by Owner's representative, for inclusion in Operation and Maintenance Manual. Certificates shall include:

    a. Listing of Owner-designated personnel completing training, by name and title.
    b. Name and title of training instructor.
    c. Date(s) of training.
    d. List of topics covered in training sessions.

4. Refer to specific equipment Articles for minimum training period duration for each piece of equipment.

END OF SECTION 23 00 50

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.

2. Balancing Domestic Water Piping Systems.

1.2 RELATED REQUIREMENTS

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

1.3 REFERENCES AND STANDARDS

A. Associated Air Balance Council (AABC)

1. National Standards for Total System Balance, latest edition.

B. National Environmental Balancing Bureau (NEBB)

1. Procedural Standards for Testing and Balancing of Environmental Systems, latest edition.

1.4 DEFINITIONS

A. The intent of this Section is to use the standards pertaining to the TAB specialist engaged to perform the Work of this Contract, with additional requirements specified in this Section. Contract requirements take precedence over corresponding AABC or NEBB standards requirements. Differences in terminology between the Specifications and the specified TAB organization standards do not relieve the TAB entity engaged to perform the Work of this Contract of responsibility from completing the Work as described in the Specifications.

B. Similar Terms: The following table is provided for clarification only:

Similar Terms		
Contract Term	AABC Term	NEBB Term
TAB Specialist	TAB Agency	NEBB Certified Firm
TAB Standard	National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems	Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems
TAB Field Supervisor	Test and Balance Engineer	Test and Balance Supervisor

C. AABC: Associated Air Balance Council.

D. NEBB: National Environmental Balancing Bureau.

E. TAB: Testing, adjusting, and balancing.

F. TAB Organization: Body governing practices of TAB Specialists.

G. TAB Specialist: An entity engaged to perform TAB Work.

1.5 ACTION SUBMITTALS

A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.

1.6 INFORMATIONAL SUBMITTALS

A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.

B. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

1. Provide list of similar projects completed by proposed TAB field supervisor.
2. Provide copy of completed TAB report, approved by mechanical engineer of record for a completed project with similar system types and of similar complexity.

C. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

1. Submit examinations report with qualifications data.

D. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

E. Interim Reports. Submit interim reports as specified in Part 3. Include list of system conditions requiring correction and problems not identified in Contract Documents examination report.

F. Certified TAB reports.

1. Provide three printed copies of final TAB report. Provide one electronic file copy in PDF format.

G. Sample report forms.

H. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

a. Instruments to be used for testing and balancing shall have been calibrated within a period of one year, or less if so recommended by instrument manufacturer and be checked for accuracy prior to start of work.

1.7 CLOSEOUT SUBMITTALS

A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.

B. Certified TAB reports, for inclusion in Operation and Maintenance Manual.

1.8 QUALITY ASSURANCE

A. Independent TAB Specialist Qualifications: Engage a TAB entity certified by AABC or NEBB.

1. The certification shall be maintained for the entire duration of TAB work for this Project. If TAB specialist loses certification during this period, the Contractor shall immediately notify the Architect and submit another TAB specialist for approval. All work specified in this Section and in other related Sections performed by the TAB specialist shall be invalidated if the TAB specialist loses certification, and shall be performed by an approved successor.

B. To secure approval for the proposed TAB specialist, submit information certifying that the TAB specialist is either a first tier subcontractor engaged and paid by the Contractor, or is engaged and paid directly by the Owner. TAB specialist shall not be affiliated with any other entity participating in Work of this Contract, including design, furnishing equipment, or construction. In addition, submit evidence of the following:

1. TAB Field Supervisor: Full-time employee of the TAB specialist and certified by AABC or NEBB.

    a. TAB field supervisor shall have minimum 10 years supervisory experience in TAB work.

2. TAB Technician: Full-time employee of the TAB specialist and who is certified by AABC or NEBB as a TAB technician.

    a. TAB technician shall have minimum 4 years TAB field experience.

C. TAB Specialist engaged to perform TAB work in this Project shall be a business limited to and specializing in TAB work, or in TAB work and Commissioning.

D. TAB specialist engaged to perform TAB work shall not also perform commissioning activities on this Project.

E. Certified TAB field supervisor or certified TAB technician shall be present at the Project site at all times when TAB work is performed.

1. TAB specialist shall maintain at the Project site a minimum ratio of one certified field supervisor or technician for each non-certified employee at times when TAB work is being performed.

F. Contractor shall notify Architect in writing within three days of receiving direction resulting in reduction of test and balance scope or other deviations from Contract Documents. Deviations from the TAB plan shall be approved in writing by the mechanical engineer of record for the Project.

G. TAB Standard:

1. Perform TAB work in accordance with the requirements of the standard under which the TAB agencies' qualifications are approved unless Specifications contain different or more stringent requirements:

    a. AABC National Standards for Total System Balance, or
    b. NEBB Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems.

2. All recommendations and suggested practices contained in the TAB standard are mandatory. Use provisions of the TAB standard, including checklists and report forms, to the extent to which they are applicable to this Project.
3. Testing, adjusting, balancing procedures, and reporting required for this Project, and not covered by the TAB standard applicable to the TAB specialist engaged to perform the Work of this Contract, shall be submitted for approval by the design engineer.

H. TAB Conference: Meet with Construction Manager and mechanical engineer on approval of the TAB strategies and procedures plan to develop a mutual understanding of the project requirements. Require the participation of the TAB field supervisor. Provide seven days' advance notice of scheduled meeting time and location. TAB conference shall take place at.

1. Agenda Items:

    a. The Contract Documents examination report.
    b. The TAB plan.
    c. Coordination and cooperation of trades and subcontractors.
    d. Coordination of documentation and communication flow, including protocol for resolution tracking and documentation.

2. The requirement for TAB conference may be waived at the discretion of the mechanical engineer of record for the Project.

I. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

J. TAB Report Forms: Use standard TAB specialist's forms approved by Construction Manager.

K. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.9 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.10 WARRANTY

A. Provide workmanship and performance warranty applicable to TAB specialist engaged to perform Work of this Contract:

1. AABC Performance Guarantee.
2. NEBB Quality Assurance Program.

B. Refer to Division 01 Specifications for additional requirements.

1.11 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

C. Coordinate TAB work with work of other trades.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contract Documents Examination Report:

1. TAB specialist shall review Contract Documents, including plans and specifications. Provide report listing conditions that would prevent the system(s) from operating in accordance with the sequence of operations specified, or would prevent accurate testing and balancing:

a. Identify each condition requiring correction using equipment designation shown on Drawings. Provide room number, nearest building grid line intersection, or other information necessary to identify location of condition requiring correction.
b. Proposed corrective action necessary for proper system operation.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

G. Examine test reports specified in individual system and equipment Sections.

H. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

I. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

J. Examine system pumps to ensure absence of entrained air in the suction piping.

K. Examine operating safety interlocks and controls on HVAC equipment.

L. Report conditions requiring correction discovered before and during performance of TAB procedures.

M. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures. TAB plan shall be specific to Project and include the following:

1. General description of each air system and sequence(s) of operation.
2. Complete list of measurements to be performed.
3. Complete list of measurement procedures. Specify types of instruments to be utilized and method of instrument application.
4. Qualifications of personnel assigned to Project.
5. Single-line CAD drawings reflecting all test locations (terminal units, grilles, diffusers, traverse locations, etc.
6. Air terminal correction factors for the following:

    a. Air terminal configuration.
    b. Flow direction (supply or return/exhaust).
    c. Effective area of each size and type of air terminal.
    d. Air density.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Automatic temperature-control systems are operational.
3. Equipment and duct access doors are securely closed.
4. Balance, smoke, and fire dampers are open.
5. Isolating and balancing valves are open and control valves are operational.
6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
7. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 23 80 00 Heating, Ventilating, and Air Conditioning."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Test each system to verify building or space operating pressure, including all stages of economizer cycle. Maximum building pressure shall not exceed 0.03 inches of pressure.

C. Except as specifically indicated in this Specification, Pitot tube traverses shall be made of each duct to measure airflow. Pitot tubes, associated instruments, traverses, and techniques shall conform to ASHRAE Handbook, HVAC Applications, and ASHRAE Handbook, HVAC Systems and Equipment.

1. Use state-of-the-art instrumentation approved by TAB specialists governing agency..
2. Where ducts' design velocity and air quantity are both less than 1000 fpm/CFM, air quantity may be determined by measurements at terminals served.

D. Test holes shall be placed in straight duct, as far as possible downstream from elbow, bends, take-offs, and other turbulence-generating devices.

E. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

F. 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.

G. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

H. Verify that motor starters are equipped with properly sized thermal protection.

I. Check dampers for proper position to achieve desired airflow path.

J. Check for airflow blockages.

K. Check condensate drains for proper connections and functioning.

L. Check for proper sealing of air-handling-unit components.

M. Verify that air duct system is sealed as specified in Section 23 80 00 “Heating, Ventilating, and Air Conditioning.”

N. Provide for adjustments or modifications to fan and motor sheaves, belts, damper linkages, and other components as required to achieve specified air balance at no additional cost to Owner.

O. Automatically operated dampers shall be adjusted to operate as indicated in Contract Documents. Controls shall be checked for proper calibration.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

    a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow. Alternative methods shall be examined for determining total CFM, i.e., Pitot-tube traversing of branch ducts, coil or filter velocity profiles, prior to utilizing airflow values at terminal outlets and inlets.

2. Measure fan static pressures as follows to determine actual static pressure:

    a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
    b. Measure static pressure directly at the fan outlet.
    c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
    d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

    a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Obtain approval from Construction Manager for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-

handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.

7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Check operation of relief air dampers. Measure total relief air quantity at each stage of normal, economizer, power exhaust, or power exhaust economizer operation, as applicable to installed equipment. Adjust relief air dampers to provide 100 percent relief in economizer mode. Ensure that relief dampers close completely upon unit shutdown.

C. Check operation of outside air dampers. Measure total outside air quantity at each stage of normal, economizer, power exhaust, or power exhaust economizer operation, as applicable to installed equipment. Adjust outside air dampers to provide 100 percent outside air in economizer mode. Ensure that outside air dampers close completely upon unit shutdown.

D. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

    a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

E. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading digital backflow compensating hood. Use outlet manufacturer's written instructions and calculating factors only when direct-reading hood cannot be used due to physical obstruction or other limiting factors. Final report shall indicate where values listed have not been obtained by direct measurement.

F. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents, if included.
2. Adjust patterns of adjustable outlets for proper distribution without drafts. Terminal air velocity at five feet above finished floor shall not exceed 50 feet per minute in occupied air conditioned spaces.

G. Do not overpressurize ducts.

3.6 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter manufacturer’s name, model number, size, type, and thermal-protection-element rating.

    a. Starter strip heater size, type, and rating.

3.7 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.8 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.

3.9 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.

1. Measure and record the operating speed, airflow, and static pressure of each fan.
2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
3. Check the condition of filters.
4. Check the condition of coils.
5. Check the operation of the drain pan and condensate-drain trap.
6. Check bearings and other lubricated parts for proper lubrication.

7. Report on the operating condition of the equipment and the results of the measurements taken. Report conditions requiring correction.

B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:

1. New filters are installed.
2. Coils are clean and fins combed.
3. Drain pans are clean.
4. Fans are clean.
5. Bearings and other parts are properly lubricated.
6. Conditions requiring correction noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.

1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
3. If calculations increase or decrease the air flow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
4. Balance each air outlet.

3.10 GENERAL PROCEDURES FOR PLUMBING SYSTEMS

A. Measure pressure drop across each backflow preventer assembly at design flows.

B. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:

1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.

    a. If impeller sizes must be adjusted to achieve pump performance, obtain approval from Construction Manager and comply with requirements in

2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.

    a. Monitor motor performance during procedures and do not operate motors in overload conditions.

3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
4. Report flow rates that are not within range given in article, Tolerances.

C. Set calibrated balancing valves, if installed, at calculated presettings.

D. Measure flow at all stations and adjust, where necessary, to obtain first balance.

1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

E. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.

F. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:

1. Determine the balancing station with the highest percentage over indicated flow.
2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
3. Record settings and mark balancing devices.

G. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.

H. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.

I. Check settings and operation of each safety valve. Record settings.

3.11 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 10 percent and minus 0 percent.
2. Air Outlets and Inlets: Plus 5 percent and minus 5 percent.
3. Multiple outlets within single room: Plus 5 percent and minus 0 percent for total airflow within room. Tolerance for individual outlets within a single room having multiple outlets shall be as for “Air Outlets and Inlets.”

B. Set plumbing systems water flow rates within plus or minus 10 percent.

3.12 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Interim Reports: Prepare periodic lists of conditions requiring correction and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.13 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing field supervisor. Report shall be co-signed by the Contractor, attesting that he has reviewed the report, and the report has been found to be complete and accurate.
2. The certification sheet shall be followed by sheet(s) listing items for which balancing objectives could not be achieved. Provide explanation for failure to achieve balancing objectives for each item listed.
3. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Project Performance Guaranty
6. Architect's name and address.
7. Engineer's name and address.
8. Contractor's name and address.
9. Report date.
10. Signature of TAB supervisor who certifies the report.

11. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
12. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

13. Nomenclature sheets for each item of equipment.
14. 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. Fan drive settings including settings and percentage of maximum pitch diameter.
    e. 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. Duct, outlet, and inlet sizes.
3. Pipe and valve sizes and locations.
4. Balancing stations.
5. Position of balancing devices.

E. Air distribution outlets and inlets shall be shown on keyed plans with designation for each outlet and inlet matching designation used in Contract Documents and TAB test reports. Room numbers shall be included in keyed plans and test reports. Where multiple outlets and inlets are installed within a single room, a designation shall be assigned and listed for each outlet and inlet in addition to room number.

F. Test Reports – General:

1. All test reports containing air or liquid flow data shall record flow values prior to system adjustment in addition to required data listed for each test report.

G. 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. Refrigerant expansion valve and refrigerant types.

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. 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.

L. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.14 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 Construction Manager.
2. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Construction Manager.
3. Construction Manager shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than 10 percent, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contact the TAB specialists' governing organization for remedial action by the governing organization under the workmanship and performance warranty. See article, Warranty.
3. If remedial action is not provided by the TAB specialists' governing organization in a timely manner, Owner may contract the services of another TAB specialist to complete the TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB specialists' final payment.

D. Prepare test and inspection reports.

3.15 ADDITIONAL TESTS

A. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 05 93

SECTION 23 80 00 - HEATING, VENTILATING AND AIR CONDITIONING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Air inlets and outlets.
2. Dampers.
3. Ductwork.
4. Insulation.

1.2 RELATED REQUIREMENTS

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

B. Section 23 00 50, Basic HVAC Materials and Methods.

C. Section 23 05 93, Testing, Adjusting, and Balancing for HVAC.

1.3 ACTION SUBMITTALS

A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.

B. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, dimensions, weight, corner or mounting point weights, furnished specialties and accessories; and installation and start-up instructions. Product data shall include applicable product listings and standards. Refer to Section 23 00 50, Basic HVAC Material and Methods for additional requirements.

C. Engineering Data: Submit fan curves and sound power level data for each fan unit. Data shall be at the scheduled capacity. Data shall include the name of the rating agency or independent laboratory.

1.4 INFORMATIONAL SUBMITTALS

A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.

B. Roof Curb Data: For roof mounted equipment where combined weight of equipment unit and roof curb or rail exceeds 400 pounds, submit calculations from manufacturer for roof curbs proving compliance with the seismic requirements of the California Building Code, and ASCE 7-10. Manufacturer shall certify that roof curbs are suitable for use indicated on Drawings and in Specifications for the seismic design category indicated in structural Contract Documents. Ca

lculations shall be stamped and signed by a State of California registered structural engineer.

C. Record of pre-installation meeting.

D. Coordinated Layouts: Submit coordinated layouts. For requirements refer to article, Coordinated Layouts, in this Section.

1.5 CLOSEOUT SUBMITTALS

A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.

B. Maintenance Data: Submit maintenance data and parts list for each piece of equipment, control, and accessory; including "trouble-shooting guide," in Operation and Maintenance Manual.

C. Record Drawings: Submit Record Drawings of installed ductwork, duct accessories, and outlets and inlets in accordance with requirements of Division 01.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: One set(s) for each belt-driven unit.
2. Provide one complete set(s) of filters for each filter bank.

1.7 COORDINATED LAYOUT

A. Coordinated layouts are required to amplify, expand and coordinate the information contained in the Contract Documents.

B. Provide minimum 1/4 inch equals one foot scaled coordinated layout drawings showing plan and pertinent section or elevation views of piping, ductwork, equipment, accessories, and electrical systems. Drawings shall be reproducible and work of each trade represented shall be fully coordinated with structure, other disciplines, and finished surfaces. Drawings shall be presented on a single size sheet. Coordinated layout drawings shall have title block, key plan, north arrow and sufficient grid lines to provide cross-reference to design Drawings.

1. Provide a stamp or title block on each drawing with locations for signatures from all contractors involved, including but not limited to the General, HVAC, Plumbing, Fire Protection, and Electrical contractors. Include statement for signature that the contractor has reviewed the coordinated layout drawings in detail and has coordinated the work of his trade.
2. Show on drawings the intended elevation of all ductwork in accordance with the following example:

B.O.D. = 9'-0"
OFFSET UP 6"
B.O.D. = 9'-6"

3. Highlight, encircle or otherwise indicate deviations from the Contract Documents on the coordinated layouts. Architect will not be responsible for identifying deviations from the original Contract Documents.

C. Since scale of contract drawings is small and all offsets and fittings are not shown, Contractor shall make allowances in bid for additional coordination time, detailing, fittings, offsets, hangers and the like to achieve a fully coordinated installation. If changes in duct size are required, equivalent area shall be maintained and the aspect ratio shall not be in excess of 2 to 1 unless approved by the engineer. Drawings shall be submitted for review prior to fabrication and installation. Drawings may be submitted in packages representing at least one quarter of the building ductwork.

D. Check routing on all ductwork before fabricating. Report any discrepancies to Architect. No extra cost will be allowed for failure to conform to above.

1.8 QUALITY ASSURANCE

A. Design Criteria:

1. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture. All gas-fired equipment shall be UL, ETL or CSA listed.
2. Supply all equipment and accessories in accordance with requirements of applicable national, state and local codes.
3. All items of a given type shall be products of the same manufacturer.
4. Scheduled equipment performance is minimum capacity required.
5. Scheduled electrical capacity shall be considered as maximum available.
6. Scheduled gas BTU input shall be considered as maximum available.

1.9 FIELD CONDITIONS

A. Interruption of Existing Services: Do not interrupt services to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of services.
2. Do not interrupt services without Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).

2.2 AIR INLETS AND OUTLETS

A. Except as otherwise indicated, provide manufacturer's standard inlets and outlets where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Ceiling, wall or floor Compatibility: Provide inlets and outlets with border styles that are compatible with adjacent ceiling, wall or floor systems, and that are specifically manufactured to fit into ceiling, wall or floor module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems that will contain each type of air outlet and inlet.

C. Refer to Schedule on Mechanical Drawings for details of inlets and outlets to be used.

2.3 AIR FILTERS

A. Provide MERV 13 disposable pleated media type. Refer to specific equipment Articles for filter depth and for exceptions to this specification. Filters shall conform to the following:

1. Standards:

    a. ASHRAE Standard 52.2-2007.
    b. Underwriters Laboratories: U.L. 900, Class 2.

2. Construction:

    a. Media: Synthetic or cotton-synthetic blend with radial pleats.
    b. Media Frame: High wet-strength beverage board.
    c. Media Support: Welded wire or expanded metal grid bonded to air leaving side of the media.

3. Performance: 2” deep filter shall have a maximum initial air resistance of 0.31 inches w.g.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Camfil Farr, Inc., model 30/30.
2. Flanders Corporation, model 40 LPD.

C. Temporary (Construction Period) Filters:

1. Install new temporary filters in all units that have filter systems installed. Temporary filters shall match the permanent filters that are specified for the units. Replace filters as needed, in accordance with manufacturer's directions, in order to provide protection for the unit prior to occupancy by the Owner.
2. If air handling units are operated during construction of the project, install temporary filters directly over each return air inlet. Filters shall match the permanent filters that are specified for the units. Select size of filter to completely cover the frame of the return air inlet, and tape filters firmly in place to eliminate any construction debris from entering the duct system or unit. Remove the temporary filters upon completion of the work, and repair all damaged paintwork.

D. Spare Filters:

1. Furnish two new, complete sets of filter cartridges for each filter bank on completion and acceptance of the work. Install one set of filters in units (prior to final air balance). Provide units designed to accommodate washable, permanent filters with one washable, permanent filter.

2.4 DAMPERS

A. Backdraft Dampers: Ruskin CBD2, counterbalanced, Nailer Industries, or equal.

B. Manual Air and Balance Dampers: Provide dampers of single blade type or multi-blade type constructed in accordance with SMACNA, "HVAC Duct Construction Standards," except as noted herein.

1. Rectangular Ductwork:

a. Single damper blades may be used in ducts up to 10 inches in height. Dampers shall be 16 gauge minimum. Provide self-locking regulators, equal to Ventlok 641. Provide end bearings equal to Ventlok 607 at each damper. Provide continuous solid 3/8 inch square shafts.
b. Multiple blade dampers shall be equal to Ruskin CD35 Standard Control Damper. Maximum width for multiple damper blades for use in rectangular duct shall not exceed 6 inches.
c. Where duct velocity may be expected to exceed 1500 fpm, provide Ruskin CD-50, or equal, low leakage dampers with airfoil blades.

2. Round Ductwork:

a. Single damper blades may be used in ducts up to 12 inches in diameter. Provide multiple blade opposed blade dampers, with connected linkage, for ductwork larger than 12 inches in diameter.
b. Damper blades for round ductwork shall be 20 gauge steel for ducts up to 12 inches diameter and 16 gauge steel for dampers larger than 12 inches damper. Provide self-locking regulators, equal to Ventlok 641, Durodyne, or equal for

operation of dampers. Provide end bearings equal to Ventlok 607 and provide continuous solid 3/8 inch square shafts.

3. Where ductwork is externally insulated, provide self-locking regulators equal to Ventlok 644, Durodyne, or equal for rectangular ductwork, and Ventlok 637, Durodyne, or equal for round ducts.

C. Where required to suit the size of damper required, provide manufacturers standard UL Classified mullions, arranged to support multiple dampers. Assembly shall be of minimum 16 gauge galvanized steel, complete with all accessory caps and framing members required for installation.

2.5 DUCTWORK

A. Construct and install sheet metal ductwork in accordance with the California Mechanical Code for 2 inches static pressure for supply air, and 2 inches minimum for return and exhaust air unless otherwise noted on Drawings.

1. Where not in conflict with the California Mechanical Code, construct and install all sheet metal ductwork in accordance with SMACNA HVAC Duct Construction Standards (Metal and Flexible). Where applicable for HVAC work, construct and install sheet metal work in accordance with SMACNA Architectural Sheet Metal Manual.
2. Provide variations in duct size, and additional duct fittings as required to clear obstructions and maintain clearances as approved by the Architect at no extra cost to the Owner.
3. Gauges, joints and bracing shall be in accordance with the California Mechanical Code.
4. Provide beading or cross breaking for all ductwork inside building. Provide cross breaking for ductwork exposed to weather.
5. At the contractor's option, ductwork may be fabricated using the Ductmate, Nexus, Quickduct, Transverse Duct Connection (TDC), Pyramid-Loc duct connection systems, or equal. Fabricate in strict conformance with manufacturer's written installation instructions and in accordance with California Mechanical Code.

    a. Seal flanged ends with pressure sensitive high density, closed cell neoprene or polyethylene tape gasket, Thermo 440, or equal.
    b. Provide metal clips for duct connections, except at breakaway connections for fire dampers and fire smoke dampers. Provide corner clips at each corner of duct, through bolted, at all locations except at breakaway connections for fire dampers and fire smoke dampers. Where used on locations exposed to weather, provide continuous metal clip at top and sides of duct, with 1 inch overhang for top side.

B. Design and installation standards:

1. SMACNA Compliance: Comply with applicable portions of Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) for all work in this section.
2. NFPA Compliance: Comply with ANSI/NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems," and ANSI/NFPA 90B, "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."
3. California Mechanical Code.

C. Duct sizes indicated are external sizes.

D. Galvanized Sheet Steel: Lock-forming quality, ASTM A924 and ASTM A653, Coating Designation G 90. Provide mill phosphatized finish for exposed surfaces of ducts exposed to view.

1. Provide mill certification for galvanized material at request of the Project Inspector.

E. Duct Sealants:

1. Sealant shall have a VOC content of 250 g/L or less.
2. Sealant shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.
3. Provide one part, non-sag, synthetic latex sealant, formulated with a minimum of 68 percent solids. Sealant shall comply with ASTM E84, Surface Burning Characteristics.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1) Design Polymerics, model DP1010.
2) Polymer Adhesive Sealant Systems Inc, model Airseal #11.
3) McGill Airseal, LLC.

F. Duct Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, straps, trim, and angles for support of ductwork.

G. Rectangular Duct Fabrication:

1. Shop fabricate ductwork of gauges and reinforcement complying with the more stringent of the following standards, except as noted herein.

a. SMACNA HVAC Duct Construction Standards
b. California Mechanical Code

2. Fabricate ducts for 2 inch pressure class with minimum duct gauges and reinforcement as follows, except as otherwise noted:

Table A		
Duct Dimension	Minimum Gauge	Joint Reinforcement Per CMC
Through 12"	26	Not Required
13" through 18"	24	Not Required
19" through 30"	24	C/4
31" through 42"	22	E/4
43" through 54"	22	F/2
55" through 60"	20	G/4
61" through 84"	20	I/2
85" through 96"	20	J/2
Over 96"	18	K/2

3. Fabricate duct fittings to match adjoining ducts and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to 1.5 times associated duct width. Fabricate to include single thickness turning vane in elbows where space does not permit the above radius or where square elbows are shown. Limit angular tapers to 30 degrees for contracting tapers and 20 degrees for expanding tapers. Turning vanes shall be E-Z Rail II, Durodyne, or equal.
4. Fabricate round supply connections at rectangular, plenum type fittings using spin-in type fittings, complete with extractor and volume control damper. Refer to Paragraph “DAMPERS” for damper requirements.
5. Provide drive slip or equivalent flat seams for ducts exposed in the conditioned space or where necessary due to space limitations. On ducts with flat seams, provide standard reinforcing on inside of duct. Duct connection to outlet on exposed duct shall be full size of outer perimeter of outlet flange.
6. Ducts exposed in the conditioned space shall be free of dents and blemishes and be mounted tight against adjacent surface with flat hangers. Remove all fabrication labels from ductwork.
7. Provide 20 gauge minimum for ductwork exposed within occupied spaces.

H. Rectangular Internally Insulated Duct Fabrication:

1. Provide internal duct lining where indicated on the Drawings, with a minimum of 10'-0" length in each direction from the fan, fan casing, or unit casing. Line all transfer ducts.

a. Where ductwork is exposed to weather or outside the building insulation envelope, provide 2 inch thick, 1-1/2 pound density internal lining with matte facing, with an R-Value of 8.0 minimum.
b. Where ductwork is within the building insulation envelope, lining shall be 1" thick, 1-1/2 pound density, with R-value of 4.2 minimum.
c. Ducts exposed in the conditioned space shall be free of dents and blemishes and be mounted tight against adjacent surface with flat hangers. Remove all fabrication labels from ductwork.
d. Where installed exposed in the conditioned space, duct shall be minimum 20 gauge with 1 inch insulation layer (minimum R-value – R-4.2).
e. Cement duct liner in place with nonflammable, non-hardening duct adhesive. Seal all raw edges of insulation inside ductwork with adhesive, including longitudinal liner edges.
f. Provide metal nosing at all locations where liner is preceded by unlined metal.
g. Provide sheet metal weld pins and washers or clinch pins and washers on all ductwork on 12 inch intervals with the first row within 3 inches of the leading edge of each piece of insulation and within 4 inches of corners. No use of adhesive mounted pins will be considered.

    1) Install clinched pin fasteners with properly adjusted automatic fastening equipment. Manual installation will not be considered.
    2) Install weld pins with properly adjusted automatic fastening equipment. Installation shall not damage the galvanized coating on the outside of the duct.

h. All ductwork, adhesives, lining, sealant, flex duct and the like shall have a flame spread of 25 or less and developed smoke rating of 50 or less when tested in accordance with one of the following test methods: NFPA 255, ASTM E84, or UL 723.
i. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

Manufacturer:	Product:
Johns Manville	Linacoustic RC
CertainTeed Corporation	ToughGard
Fosters Adhesive	85-62
Swifts Adhesive	7336

I. Round and Oval Ductwork Fabrication:

1. Round and oval duct and fittings shall be spiral lockseam or longitudinal seam as indicated in table below. Provide couplings to join each length of duct.

    a. At contractors' option, round or oval ductwork may be utilized in place of rectangular ductwork shown on Drawings, provided available space allows installation of round or oval ductwork without compromising space required for installation of products and systems of other trades.

        1) Round or oval ductwork utilized in place of rectangular ductwork shown on Drawings shall be sized to have a static pressure loss equivalent to rectangular duct shown on Drawings.
        2) Unlined round or oval duct shall not be utilized in place of rectangular internally lined ductwork shown on Drawings.

2. Fabricate duct fittings to match adjoining ducts and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to 1.5 times associated duct width. Provide two-piece, die-stamped, 45-degree to 90-degree elbows for sizes up to 12 inches; five-piece, 90-degree elbows for sizes 12 inches and above; conical tees; and conical laterals. All reducers shall be placed after a tap has been made on the duct main. Reducers shall be long-taper style.
3. Round Ductwork: Construct of galvanized sheet steel complying with ANSI/ASTM A 653 by the following methods and in minimum gauges listed.

Diameter	Minimum Gauge	Method of Manufacture
Up to 14"	26	Spiral Lockseam
15" to 23"	24	Spiral Lockseam
24" to 36"	22	Spiral Lockseam
37" to 50"	20	Spiral Lockseam
51" to 60"	18	Spiral Lockseam
Over 60"	14	Longitudinal Seam

4. Provide locked seams for spiral duct; fusion welded butt seam for longitudinal seam duct.
5. Fittings and Couplings: Construct of minimum gauges listed. Provide continuous welds along seams at exposed ducts. Provide spot weld bonded seams at concealed ducts.

Diameter	Minimum Gauge
3" to 36"	20
38" to 50"	18
Over 50"	16

6. Ducts exposed in the conditioned space shall be free of dents and blemishes and be mounted tight against adjacent surface with flat hangers. Remove all fabrication labels from ductwork.
7. Provide 20 gauge minimum for ductwork exposed within occupied spaces.

J. Duct Access Doors:

1. Duct Access: Provide hinged access door in rectangular ducts for access to fire dampers, control equipment, etc. Access door size shall be duct diameter wide by duct diameter high for all ducts under 24 inches. Ducts over 24 inches in diameter shall have 24-inch by 18-inch access doors. Minimum size access doors shall be 6 inches by 6 inches.
2. Provide hinged style access doors for round ductwork, NCA Manufacturing, Inc., Model AD-RD-87, Pottorff Series 60, or equal. Access doors shall be 16 gauge galvanized steel with continuous piano hinge. Locks shall be plated steel strike and catch. Provide 1" x 3/8" Polyethylene "Perma Stik" gasket all around door.

K. Flexible Air Ducts:

1. Provide exterior reinforced laminated vapor barrier, fiberglass insulation, encapsulated spring steel wire Helix, and impervious, smooth, non-perforated interior vinyl liner. Individual lengths of flexible ducts shall contain factory fabricated steel connection collars.

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

        1) C.A. Schroeder, Inc., Cal Flex model 2PMJ.
        2) ThermaFlex model M KC.

2. Factory made air ducts shall be approved for the use intended and shall conform to the requirements of UL 181 and NFPA 90A. Each portion of a factory-made air duct system shall be identified by the manufacturer with a label or other suitable identification indicating compliance with UL 181, Class 1. Ducts shall be UL listed Class 1, maximum 25/50 smoke and flame spread and shall be installed in accordance with the terms of their listing and the requirements of SMACNA HVAC Duct Construction Standards (Metal and Flexible). Factory-made air ducts shall have the following minimum R-values: R-6.0 for ductwork installed within the building insulation envelope, R-8.0 for ductwork installed outside the building insulation envelope.

3. Flexible ductwork shall be maximum of 5 feet long, and shall be extended to the fullest possible length, in order to minimize pressure drop in the duct.
4. Flexible ducts shall be selected for minimum of 6 inch positive static pressure and minimum of 1 inch negative static pressure.
5. Duct Access Panels:

    a. Provide duct access panel assembly of the same material and gauge used for the duct. Duct access panels shall conform to the following:

        1) Fasteners: Black steel or stainless steel to match material used for the duct. Panel fasteners shall not penetrate duct wall.
        2) Gasket: Comply with NFPA 96, grease-tight, high temperature ceramic fiber, rated for minimum 1500 °F.

2.6 INSULATION MATERIALS

A. General:

1. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).
2. Products shall not contain asbestos, lead, mercury, or mercury compounds.
3. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
4. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
5. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
6. Test insulation, jackets and lap-seal adhesives as a composite product and confirm flame spread of not more than 25 and a smoke developed rating of not more than 50 when tested in accordance with UL723 or ASTM E84.
7. Adhesives and sealants shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

B. Insulation Materials:

1. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

        1) Aeroflex USA, Inc.
        2) Armacell LLC.
        3) K-Flex USA.

2. Mineral-Fiber, Preformed Pipe Insulation:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1) Johns Manville; a Berkshire Hathaway company.
2) Knauf Insulation.
3) Manson Insulation Inc.
4) Owens Corning.

b. 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-SSL.

3. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Provide 2-inch wide stapling and taping flange.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1) CertainTeed Corporation.
2) Johns Manville.
3) Knauf Insulation.
4) Owens Corning.

C. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Design Polymerics.

b. Foster Brand; H. B. Fuller Construction Products.
c. Knauf Insulation.

2. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
3. Service Temperature Range: 0 to plus 180 deg F.
4. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Design Polymerics.

b. Childers Brand; H. B. Fuller Construction Products.

c. Foster Brand; H. B. Fuller Construction Products.

2. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Design Polymerics.

b. Childers Brand; H. B. Fuller Construction Products.
c. Foster Brand; H. B. Fuller Construction Products.
d. Knauf Insulation.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: 0 to plus 180 deg F.
4. Color: White.

F. Field Applied Jackets:

1. PVC Jacket and Factory Fabricated Fitting Covers: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1) Johns Manville, model Zeston, with Zeston 2000 fitting covers.
2) Proto Corporation, model LoSmoke.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1) Childers Brand; H. B. Fuller Construction Products.
2) ITW Insulation Systems; Illinois Tool Works, Inc.
3) RPR Products, Inc.

b. Finish and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Outdoor Applications: 2.5-mil- thick polysurlyn.
d. Factory-Fabricated Fitting Covers:

1) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
2) Tee covers.
3) Flange and union covers.
4) End caps.
5) Beveled collars.
6) Valve covers.
7) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

PART 3 - EXECUTION

3.1 AIR INLETS AND OUTLETS INSTALLATION

A. Provide all air inlets and outlets with gaskets and install so that there will be no streaking of the walls or ceilings due to leakage. Duct connection to outlet on exposed duct shall be full size of outer perimeter of outlet flange.

B. Unless otherwise indicated on Drawings, provide rectangular galvanized steel plenum on top of each diffuser and ceiling return for connection to ductwork. Line plenum with internal insulation as indicated for lined ductwork. Size plenum to allow full opening into air terminal. Plenum sheet metal gauge shall be equal to gauge for rectangular equivalent of the branch duct serving the air inlet or outlet.

C. Ceiling-mounted air inlets, outlets, or other services installed in T-Bar type ceiling systems shall be positively attached to the ceiling suspension main runners or to cross runners with the same carrying capacity as the main runners.

1. Air inlets, outlets, or other services weighing not more than 56 pounds shall have two No. 12 gauge hangers connected from the terminal or service to the structure above. These wires may be slack.
2. Support air inlets, outlets, or other services weighing more than 56 pounds directly from the structure above by approved hangers. Provide 4 taut 12 gauge wires each, attached to the fixture and to the structure above. The 4 taut 12 gauge wires, including their attachment to the structure above must be capable of supporting 4 times the weight of the unit.
3. Secure air inlets and outlets to main runners of ceiling suspension system with two No. 8 sheet metal screws at opposing corners.

D. Furnish all air inlets and outlets with a baked prime coat unless otherwise noted. Provide off-white baked enamel finish on ceiling-mounted air inlets and outlets. Paint exposed mounting screws to match the material being secured.

E. Air inlets and outlets shall match all qualities of these specified including appearance, throw, noise level, adjustability, etc.

3.2 TEMPORARY FILTERS

A. Provide temporary filters for fans that are operated during construction; after construction dirt has been removed from the building install new filters at no additional cost to the Owner. In addition to temporary filters at filter location, provide temporary filters on all duct openings which will operate under a negative pressure.

1. Filters used for temporary operation shall be the same as permanent filters for the application. Filters used for duct openings may be 1 inch thick pleated media disposable type.

3.3 DAMPER INSTALLATION

A. All dampers automatically controlled by damper motors are specified under "Temperature Control System" except those specified with items of equipment.

B. Provide opposed blade manual air dampers at each branch duct connection and at locations indicated on the drawings and where necessary to control air flow for balancing system. Provide an opposed blade balancing damper in each zone supply duct. Provide an access panel or Ventlok flush type damper regulator on ceiling or wall for each concealed damper.

C. Provide 18 inch x 12 inch minimum hinged access doors in ductwork and furring for easy access to each fire damper; insulated access doors in insulated ducts. Label access doors with 1/2 inch high red letters.

1. Provide Ventlok Series 100, Durodyne, or equal access doors with hardware for convenient access to all automatic dampers and other components of the system, insulated type in insulated ducts. Provide Ventlok #202 for light duty up to 2 inch thick doors, #260 heavy-duty up to 2 inch thick doors and #310 heavy-duty for greater than 2 inch thick doors. Provide #260 hinges on all hinged and personnel access doors; include gasketing.

3.4 DUCTWORK INSTALLATION

A. General:

1. Assemble and install ductwork in accordance with recognized industry practices which will achieve air tight and noiseless (no objectionable noise) systems capable of performing each indicated service. Install each run with minimum of joints. Align ductwork accurately at connections within 1/8 inch misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers, and anchors of type which will hold ducts true to shape and to prevent buckling. Where possible, install ductwork to clear construction by 1/4 inch minimum, except at air inlets and outlets. Where ductwork will not clear construction, secure duct firmly to eliminate noise in the system.
2. Duct Joints: Install duct sealers, pop rivets or sheet metal screws at each fitting and joint. Duct sealers shall be fire retardant. Sheet metal screws for joints shall be minimum #10 size galvanized.

3. Where ductwork is left exposed within a room, the same shall be run true to plumb, horizontal, or intended planes. Where possible, uniform margins are to be maintained between parallel lines and/or adjacent wall, floor, or ceiling surfaces.
4. Horizontal runs of ductwork suspended from ceilings shall provide for a maximum headroom clearance. The clearance shall not be less than 6'-6" without written approval from the Architect.
5. Provide sheet metal angle frame at all duct penetrations to wall, floor, roof, or ceiling.
6. Paint inside of ducts, visible through grille, dull black.
7. Where ductwork is installed in finished areas of buildings that do not have ceilings, paint ductwork, support hangers, and air inlets and outlets to match adjacent architectural surfaces, or as directed by Architect.
8. At the time of rough installation, or during storage on the construction site and until final startup of the heating and cooling equipment, duct and other related air distribution component openings shall be covered with tape, plastic, sheet metal, or other methods acceptable to the enforcing agency.

B. Firestopping:

1. Pack the annular space between duct openings and ducts penetrating floors and walls with UL listed fire stop, and sealed at the ends. All pipe penetrations shall be UL listed, Hilti, 3M Pro-Set, or equal.

    a. Install fire caulking behind mechanical services installed within fire rated walls, to maintain continuous rating of wall construction.

2. Firestopping systems to be installed in strict accordance with manufacturer's instructions.
3. Alternate firestopping systems are acceptable if approved equal. However, any deviation from the above specification requires the Contractor to be responsible for determining the suitability of the proposed products and their intended use, and the Contractor shall assume all risks and liabilities whatsoever in connection therewith.

C. Upper connection of support to wood structure shall be with wood screws or lag screws in shear fastened in the upper one half of the wood structural member. Fasteners shall conform to the following schedule:

For ducts with P/2=30"	#10 x 1-1/2" wood screw
For ducts with P/2=72"	1/4"x 1-1/2" lag screw
For ducts with P/2 over 73"	3/8"x 1-1/2" lag screw

D. Upper connection in tension to wood shall not be used unless absolutely necessary. Where deemed necessary the contractor shall submit calculations to show the size fastener and penetration required to support loads in tension from wood in accordance with the following schedule:

For ducts with P/2=30"	260 pounds per hanger

For ducts with P/2=72"	320 pounds per hanger
For ducts with P/2=96"	460 pounds per hanger
For duct with P/2 larger than 120"	NOT ALLOWED

E. Upper connection to manufactured truss construction must comply with truss manufacturers published requirements and Structural Engineers requirements.

F. Where ducts pass through interior partitions and exterior walls, conceal space between construction opening and duct or duct plus insulation with sheet metal flanges of same gauge as duct. Overlap opening on four sides by at least 1-1/2 inches.

G. Support ductwork in manner complying with SMACNA "HVAC Duct Construction Standards," hangers and supports sections. Where special hanging of ductwork is detailed or shown on Drawings, Drawings shall be followed. Angles shall be attached to overhead construction in a manner so as to allow a minimum of 2 inches of movement in all directions with no bending or sagging of the angle.

1. Except where modified in individual paragraphs of this Section, provide hanger support with minimum 18 gauge straps, 1 inch wide. Fold duct strap over at bottom of duct.
2. Install duct supports to rectangular ducts with sheet metal screws. Provide one screw at top of duct and one screw into strap at bottom of duct.

H. Installation of Flexible Ductwork:

1. Provide flexible ducts with supports at 30 inch centers with 2 inch wide, 26 gauge steel hanger collar attached to the structure with an approved duct hanger. Installation shall minimize sharp radius turns or offsets.

   a. Supports shall be in accordance with SMACNA HVAC Duct Construction Standards (Metal and Flexible).
   b. Flexible duct bends shall be not less than 1-1/2 duct diameter bend radius.

2. Make connections to rigid duct and units with Panduit style draw band at inner liner material, and a second draw band over the outer vapor barrier material.
3. Make connection to duct with spin-in fittings, with air scoop and balance damper.

3.5 DUCTWORK SEALING AND LEAK TESTING

A. All ductwork shall receive a Class A seal.

B. Seal airtight all joints and seams, including standing seams and manufactured joints and seams, of all supply, return and exhaust ducts except those exposed in conditioned space.

C. Leakage Classes:

Pressure Class	Leakage Class

	Round Duct	Rectangular Duct
2"W.G. or less	8	16
4"W.G. or greater	2	4

D. All duct systems (supply, return, outside air intake, and exhaust), except those identified on compliance forms on Drawings as requiring Acceptance Testing per the requirements of the California Energy Code, shall be tested in accordance with the requirements of SMACNA "HVAC Air Duct Leakage Test Manual." Test pressure shall be equal to the pressure class of the duct. For additional duct leak testing requirements, refer to Section 23 00 50, "Basic HVAC Materials and Methods," Article, "Acceptance Requirements."

3.6 HANGER AND SUPPORT INSTALLATION

A. General: Support ductwork, equipment and piping so that it is firmly held in place by approved iron hangers and supports, and special hangers. Hanger and support components shall support weight of ductwork, equipment and pipe, fluid, and pipe insulation based on spacing between supports with minimum factor of safety of five based on ultimate strength of material used. Do not exceed manufacturer's load rating. Pipe attachments or hangers, of same size as pipe or tubing on which used, or nearest available. Rigidly fasten hose faucets, fixture stops, compressed air outlets, and similar items to the building construction. The Architect shall approve hanger material before installation. Where building structural members do not match piping and ductwork support spacing, provide "bridging" support members firmly attached to building structural members in a fashion approved by the structural engineer.

1. Materials, design, and type numbers for support of piping per Manufacturers' Standardization Society (MSS), Standard Practice (SP)-58.

    a. Provide copper-plated or felt-lined hangers for use on uninsulated copper tubing.

2. Materials and design for ductwork support shall be per SMACNA "HVAC Duct Construction Standards, Metal and Flexible."

B. Duct Hanger and Support Spacing: Conform to Requirements of CMC and SMACNA "HVAC Duct Construction Standards, Metal and Flexible."

C. Duct Support to Structure:

1. Upper connection of support to wood structure shall be with wood screws or lag screws in shear fastened in the upper one half of the wood structural member. Fasteners shall conform to the following schedule:

For ducts with P/2=30"	#10 x 1-1/2" wood screw
For ducts with P/2=72"	1/4"x 1-1/2" lag screw
For ducts with P/2 over 73"	3/8"x 1-1/2" lag screw

2. Upper connection in tension to wood shall not be used unless absolutely necessary. Where deemed necessary the contractor shall submit calculations to show the size fastener and penetration required to support loads in tension from wood in accordance with the following schedule:

For ducts with P/2=30"	260 pounds per hanger
For ducts with P/2=72"	320 pounds per hanger
For ducts with P/2=96"	460 pounds per hanger
For duct with P/2 larger than 120"	NOT ALLOWED

3. Install concrete inserts for support of ductwork in coordination with formwork as required to avoid delays in work.
4. Upper connection to manufactured truss construction must comply with truss manufacturers published requirements and Structural Engineers requirements.

3.7 INSULATION AND FIELD-APPLIED JACKET INSTALLATION

A. General:

1. The term "piping" used herein includes pipe, air separators, valves, strainers and fittings.
2. Clean thoroughly, test and have approved, all piping and equipment before installing insulation and/or covering.
3. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, ductwork, and equipment.
4. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment as specified in insulation system schedules.
5. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
6. Install insulation with longitudinal seams at top and bottom of horizontal runs.
7. Install multiple layers of insulation with longitudinal and end seams staggered.
8. Keep insulation materials dry during application and finishing.
9. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
10. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
11. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
12. For piping, ductwork, and equipment, with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.
13. Repair all damage to existing pipe, duct and equipment insulation whether or not caused during the work of this contract, to match existing adjacent insulation for thickness and finish, but conforming to flame spread and smoke ratings specified above.

14. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

    a. Install insulation continuously through hangers and around anchor attachments.
    b. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
    c. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
    d. Cover inserts with jacket material matching adjacent insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

B. Duct Insulation Installation:

1. General:

    a. Insulation applied to the exterior surface of ducts located in buildings shall have a flame spread of not more than 25 and a smoke-developed rating of not more than 50 when tested as a composite installation including insulation, facing materials, tapes and adhesives as normally applied. Material exposed within ducts or plenum shall have a flame-spread rating of not more than 25 and a smoke-developed rating of not more than 50.
    b. Duct insulation applied to the exterior surface of ducts installed outside the building insulation envelope shall meet minimum R-value of R-8 at 3 inches thickness and 3/4 pound per cubic foot density.
    c. Duct insulation applied to the exterior surface of ducts installed within the building insulation envelope shall meet minimum R-value of R-4.2 at 1-1/2 inches thickness and 3/4 pound per cubic foot density.

2. Mineral Fiber Blanket Installation:

    a. Insulate all unlined concealed supply and return ducts with fiberglass duct wrap, manufactured as a blanket of glass fibers factory laminated to a reinforced foil/kraft vapor retarding facing. Provide 2 inch stapling and taping flange. Wrap insulation entirely around duct and secure with outward clinching staples on 6 inch centers. Provide mechanical fasteners at maximum 18 inch centers for all bottoms of duct which are greater than 24 inches. Lap all insulation joints 3" minimum. Insulate ducts installed tight against other work before hanging in place. Seal all seams, both longitudinal and transverse, and all staple and mechanical fastener penetrations of facing with scrim backed foil tape or recommended sealant, to provide a vapor tight installation.

3. PVC Jacket Installation:

    a. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1) Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.8 TEMPERATURE CONTROL SYSTEM INSTALLATION

A. Provide thermostats where indicated on drawings. All wiring shall be in conduit. Provide all relays, transformers and the like to render the control system complete and fully operable. All control conduit to be rigid steel type.

3.9 EQUIPMENT START-UP

A. Initial start-up of the systems and pumps shall be under the direct supervision of the Contractor.

B. Equipment start-up shall not be performed until the piping systems have been flushed and treated and the initial water flow balance has been completed.

C. It shall be the responsibility of the Contractor to assemble and supervise a start-up team consisting of controls contractor, start-up technician, and test and balance contractor; all to work in concert to assure that the systems are started, balanced, and operate in accordance with the design.

D. After start-up is complete, instruct the Owner's personnel in the operation and maintenance of the systems. Obtain from the Owner's representative a signed memo certifying that instruction has been received.

E. For additional requirements, refer to article, Check, Test and Start Requirements, in Section 23 00 50, Basic HVAC Materials and Methods.

3.10 TESTING AND BALANCING

A. For testing and balancing requirements, refer to Section 23 05 93, Testing and Balancing for HVAC.

3.11 CLEANING AND PROTECTION

A. As each duct section is installed, clean interior of ductwork of dust and debris. Clean external surfaces of foreign substances that might cause corrosive deterioration of metal or where ductwork is to be painted.

B. Temporary Closure: At ends of ducts that are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering that will prevent entrance of dust and debris until connections are to be completed.

C. As each internally lined duct section is installed, check internal lining for small cuts, tears, or abrasions. Repair all damage with fire retardant adhesive.

3.12 INDOOR DUCT INSULATION SCHEDULE

A. Ducts Located Within Building Thermal Envelope:

1. Minimum R-Value = R-4.2.
2. Supply and Return Ducts: Mineral Fiber Blanket, 1-1/2 inches thick, 0.75 lb/cu. ft.

B. Ducts Located Within Building Outside Thermal Envelope:

1. Minimum R-Value – R-8.0.
2. Supply and Return Ducts: Mineral Fiber Blanket, 3 inches thick, 0.75 lb/cu. ft.

3.13 OUTDOOR DUCT INSULATION SCHDULE.

A. Minimum R-Value = R-8.

B. Refer to article, Ductwork, for internal duct lining. Provide 2 inches thick internal duct lining where indicated on Drawings.

3.14 INDOOR FIELD-APPLIED DUCT JACKET SCHEDULE

A. Insulated ducts in concealed spaces: None.

B. Insulated ducts in exposed unconditioned spaces: PVC, 20 mils thick.

END OF SECTION 23 80 00

SECTION 26 05 00
GENERAL REQUIREMENTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK:

A The work of this Section consists of providing all required labor, supervision, materials and equipment (except equipment furnished by the Owner to be installed by the Contractor) to satisfactorily complete the work shown on the drawings and/or specified in all Sections of Division 26 and all other work and miscellaneous items, not specifically mentioned, but reasonably inferred for a complete and fully operating facility. The work shall include but not be limited to the following:

1. Furnish and install all required in-place equipment, conduits, conductors, cables and any miscellaneous materials for the satisfactory interconnection and operation of all associated electrical systems.

1.02 RELATED WORK:

A This Section provides the basic Electrical Requirements which supplement the General Requirements of Division 1 and apply to all Sections of Division 26.

1.03 STANDARDS AND CODES:

A All work and material shall be in compliance with and according to the requirements of the latest revision of the following standards and codes:

1. California Electrical Code (CEC)
2. National Fire Protection Association (NFPA):
   a. 70 National Electrical Code (NEC)
3. American National Standards Institute (ANSI) Publications:
   a. C2-02 National Electrical Safety Code
4. Code of Federal Regulations (CFR):
   a. 29 CFR 1910.147 Control of Hazardous Energy (Lock Out/Tag Out)
5. Electronics Industries Association / Telecommunications Industries Association (EIA / TIA)
6. Institute of Electrical and Electronics Engineers (IEEE)
7. National Electrical Testing Association (NETA):
   a. Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems, Standard ATS
8. National Electrical Manufacturers Association (NEMA)
9. Occupational Safety and Health Act (OSHA) Standards
10. State of California Public Utilities Commission:
    a. General Order 128 Rules for Construction of Underground Electric Supply and Communication Systems
11. Variances: In instances where two or more codes are at variance, the most restrictive requirement shall apply.
12. Underwriter Laboratories (UL) listing is required for all equipment and materials where such listing is offered by the Underwriters Laboratories. Safety labeling and listing by other organizations, such as ETL Testing Laboratories, may be substituted for UL labeling and

listing if acceptable to the Owner. Provide service entrance labels for all equipment required by the NEC to have such labels.

1.04 SUBMITTALS:

A As specified in Division 1. Submit to the Engineer shop drawings, manufacturer's data and certificates for equipment, materials and finish, and pertinent details for each system specified. Obtain approval before procurement, fabrication, or delivery of the items to the job site. Partial submittals are not acceptable and will be returned without review.

B Submittals are required for all items, regardless of whether they are furnished as specified or are substituted.

C Submittals shall be provided prior to the purchasing and installation of the item(s) being submitted. Any work done prior to the final approval of the submittal shall be done at risk and any modifications, changes, or re-work that may be required resulting from the final submittal review shall be provided by the Contractor at no additional cost to the project.

D Information to be submitted includes manufacturer's name, trade name, equipment model number, nameplate data, equipment drawings including: size, layout dimensions and capacity, manufacturer's descriptive literature of cataloged products, diagrams, fault and coordination study, seismic calculations, test data, and performance and characteristic curves as applicable. Furnish project specification and paragraph reference, applicable Federal, Industry and Technical Society Publication References, and years of satisfactory service of each item required to establish contract compliance. Photographs of existing installations and data submitted in lieu of catalog data are not acceptable and will be returned without approval.

E If submittal information includes multiple products, items being submitted for approval shall be clearly identified and Items not to be used on the project shall be clearly marked out. Submittals consisting of manufacturer's catalogs without clearly marking out items not being used will be returned as not reviewed.

F Organize submittals for equipment and items related to each specification section together as a package.

G Submit submittal packages in digital PDF format.

1. Certificates of Conformance: Submit manufacturer's certifications as required on products, materials, finish, and equipment indicated in the technical sections. Certifications shall be documents prepared specifically for this contract. Preprinted certifications and copies of previously submitted documents will not be acceptable. The manufacturer's certifications shall name the appropriate products, equipment, or materials and the publication specified as controlling the quality of that item. Certification shall not contain statements that imply the item does not meet requirements specified, such as "as good as", "achieve the same end use and results as materials formulated in accordance with the referenced publications;" or "equal or exceed the service and performance of the specified material." Certifications shall state that the item conforms to the requirements specified. Certificates shall be printed on the manufacturer's letterhead and shall be signed by the manufacturer's official, authorized to sign certificates of conformance.

H Substitutions:

1. The equipment included in the Contract Documents is used to establish standards of quality, utility, size, and appearance. Equipment which in the opinion of the Engineer is equal in quality, utility, size, and appearance will be approved as substitutions to that specified.
   a. Products that are specified by manufacturer, trade name or catalog number establish a standard of quality and do not prohibit the use of equal products of other manufacturers provided they are approved by the Engineer prior to bidding.
2. Substitutions will be accepted for review where there is a reasonable reason for the substitution. Reasonable reasons include:
   a. Cost savings to the Owner. Include deductive change order with submittal.
   b. A product with features providing additional benefits to the end user.
   c. Improved finished environment, lay out of the final installation, or space savings over the specified equipment.
   d. Delivery considerations.
   e. Owner's specific requests.
3. Where items are noted as "or equal", a product of equal design, construction and performance will be considered.
4. Any item proposed as a substitute shall be accompanied by the following:
   a. Drawings and/or data giving sizes, capacities, all pertinent test data, catalog cut sheets, product information, and all other necessary information required to substantiate that the product is equal or exceeds that specified.
   b. A summary sheet noting each performance characteristic noted in the specification section or elsewhere in the contract documents of the specified product and the corresponding performance characteristics of the proposed substitution. The summary sheet shall contain the following information:
      1) Reason for Substitution Request
      2) Pertinent Performance Characteristics
      3) Specified Product Values
      4) Substituted Product Values
   c. Any substitution request that does not include the above information shall be rejected.
   d. Refer to the end of this specification section for an example form to be used for substituted products. A Microsoft Word version of the form can be provided to the Contractor for their use upon request.
5. Substitutions shall be equal, in the opinion of the Engineer, to the specified equipment. The burden of proof of such shall rest with the Contractor. When the Engineer in writing accepts a substitution, it is with the understanding that the Contractor guaranteed the substituted equipment to be equal to the one specified and dimensioned to fit within the construction. Approved substitutions shall not relieve the Contractor of responsibilities for the proper execution of the work, or from any provisions of the Plans or Specifications.
6. Contractor shall be responsible for coordination of the substituted products with other trades. Provide all additional connectivity, equipment, increased wire/conduit size, installation hardware, testing, and other miscellaneous appurtenances as required for a complete and fully functional installation.
7. Only one substitution will be considered for each product specified.

8. Alternate manufacturers must be submitted for approval 10 days prior to bid date unless noted otherwise in Division 1.
9. The Contractor shall be responsible for all expenses in connection with the substitution materials, process, and equipment, including the effect of his/her substitution on him/her, his/her sub-Contractor's or other Contractor's work. No substitution shall be permitted without written authorization of the Engineer. Any assumptions on the acceptability of a proposed substitution prior to acceptance by the Engineer are at the sole risk of the Contractor.

I Change Orders:

1. Where a change to the contract documents would result in a credit due to the Owner or a value add change to the project, provide a detailed change order request for the Engineer to review.
2. It shall be understood that the Engineer's review of costs associated with the change order shall not constitute approval of the change order or their associated costs. The Engineer's review shall be intended to assist the Owner in evaluating the costs associated with the change only. Final approval or rejection of the change order shall be at the discretion of the Owner.
3. Change order requests shall include the following information:
   a. Description of the change
   b. Reference to the document or written direction to make the change:
      1) In the case of design-team directed changes, reference the drawing/sketch number or RFI number.
      2) In the case of Owner-directed changes, reference the email, memo, or other written direction from the Owner and provide a copy of the direction.
   c. Detailed cost breakdown for the change:
      1) Line item for each material noting:
         (a) Material used (e.g. ¾" EMT)
         (b) Total quantity (e.g. 200lf)
         (c) Unit cost (e.g. $2/lf)
         (d) Total materials cost (e.g. $400)
         (e) Unit labor hours (e.g 6hrs/100lf)
         (f) Total labor hours (e.g. 12hrs)
         (g) Hourly rate (e.g. $90/hr)
         (h) Total labor cost (e.g. $1,080
      2) Total labor hours for each position (e.g. Journeyman vs. Superintendent)
      3) Total materials cost
      4) Overhead
      5) Profit
      6) Total change order value (positive for value added changes, negative for credits)

J Closeout Submittals:

1. As-built drawings: Submit As-Built Record documents as in accordance with section 3.05 below.

2. Cost analysis: Submit final cost information including original bid and any change orders broken down by system, material and labor costs (as applicable):
   a. Power distribution
   b. Lighting and lighting controls
   c. Low Voltage systems
3. Operation and Maintenance Manuals: Furnish O & M Manuals for equipment where manuals are specified in the equipment specifications or are specified in Division 1. Electrical O & M Manuals shall be provided in a single transmittal and shall include as a minimum:
   a. Copies of equipment supplied on the project.
   b. Instruction manuals including operation instructions and maintenance requirements/recommendations.
   c. List of suppliers for all equipment with addresses and telephone numbers.
   d. List of service support for all equipment with addresses and telephone numbers.
   e. Copies of all test reports required in Division 26 specification sections.
   f. Spare Parts: For each piece of equipment, submit a list of recommended spare parts. Include part numbers and the name, address, and telephone number of the supplier.
   g. Other closeout documentation and test results as required under other sections of the specifications.
   h. Warranty for all work, equipment, and systems, including Contractor's general warranty.
   i. All warranties begin as per the Contract, Division 1 or final acceptance of the Work by the Owner, Architect, Engineer, and Authority Having Jurisdiction, which ever is later.
      1) Lamps, drivers, and ballasts are to be covered as per specification 26 50 00.
      2) Manufacturer's Warrantees and Guarantees that are longer than the base contract/specified amount are to be provided with the manuals.
      3) The Contractor is responsible for all Warranty and Guarantee work whether or not the Manufacturer also Warrantees and Guarantees the product.

1.05 CONTRACT DOCUMENTS:

A Review the Drawings and Specification Divisions of other trades and perform the electrical work that will be required for the installations.
1. Should there be a need to deviate from the Electrical Drawings and Specifications, submit written details and reasons for all changes to the Engineer for favorable review.
2. All drawings and divisions of these specifications shall be considered as whole. This Contractor shall report any apparent discrepancies prior to submitting bids.
3. Should there be a conflict or discrepancy between the drawings and specifications, or between different drawings sheets, or between different specification sections, the most expensive option shall be required, at the discretion of the Engineer.

B Drawings:
1. The Drawings shall govern the general layout of the completed construction:
   a. Locations of equipment, inserts, anchors, panels, pullboxes, manholes, conduits, stub-ups, fittings, power and convenience outlets, lighting fixtures and ground connections

are approximate unless dimensioned; verify locations with the Engineer prior to installation. Field verify scaled dimensions on Drawings.

b. The general arrangement and location of existing conduits, piping, apparatus, etc., is shown as existing on drawings or specified. The drawings and specifications are for the assistance and guidance of the Contractor, exact locations, distances and elevations are governed by actual field conditions. Extreme accuracy of data given herein and on the drawings is not guaranteed. Minor changes may be necessary to accommodate work. The Contractor is responsible for verifying existing conditions. Should it be necessary to deviate from the design due to interference with existing conditions or work in progress, claims for additional compensation shall be limited to those for work required by unforeseen conditions as determined by the Engineer.

1.06 COORDINATION:

A Coordinate the electrical work with the other trades, code authorities, utilities and the Engineer:

1. Failure to accomplish this coordination is not a basis for additional cost reimbursement to the Contractor.
2. Coordinate does not mean to only send a Request For Information. Coordinate implies that the Contractor is to take the lead in bringing all of the necessary organizations together to coordinate the work and to provide for the associated costs.

B Where connections must be made to existing installations, properly schedule all the required work, including the power shutdown periods. Schedule and carry out shutdowns so as to cause the least disruption to operation of the Owner's facilities:

1. Include costs for work during non-normal working hours and temporary facilities as may be required.
2. Include costs as necessary for sub-Contractors as necessary to accomplish the specified work.

C When two trades join together in an area, make certain that no electrical work is omitted. Failure to accomplish this coordination is not a basis for additional cost reimbursement to the Contractor.

D Operations:

1. Perform all work in compliance with Division 1:
   a. Keep the number and duration of power shutdown periods to a minimum.
   b. All shutdowns which would interfere with the operations of Owner's equipment or facilities shall be coordinated with the Owner a minimum of 15 days in advance.
      1) Where Owner's equipment or facilities must remain operational during the shutdown, provide sufficient means to temporarily backup the interrupted services for the duration of the interruption.
   c. Show all proposed shutdowns and their expected duration on the construction schedule.
      1) If the construction schedule is created and maintained by others, make sure that the associated information is incorporated.
      2) Failure by the Contractor to properly schedule and plan for such activities is not a basis for additional compensation.
   d. Carry out shutdown only after the Engineer has favorably reviewed the schedule. Submit power/communications interruption schedule 15 days prior to date

of interruption. Failure to provide schedule with adequate review time may result in rescheduling of the work at the Contractor's expense.

E Construction Power:
1. See Division 1 Temporary Utilities.

F Storage:
1. Provide adequate storage for all equipment and materials which will become part of the completed facility so that it is protected from sun, weather, condensation, dust, water, or construction operations.

G Damaged Products:
1. Notify the Engineer in writing in the event that any equipment or material is damaged. Obtain approval from the Engineer and Manufacturer before making repairs to damaged products.

H Order material in such a timely manner and after approval of the same so as to insure that the approved material is available to be installed on site in a timely manner. Additional costs or substitutions necessitated because the Contractor failed to order material in a timely manner are not reimbursable. Costs associated with processing of paperwork by the Owner and design consultants resultant of such failures to coordinate the work by the Contractor shall have such costs reimbursed by the Contractor.

1.07 LOCATIONS:

A General: Use equipment, materials and wiring methods suitable for the types of locations in which they are located.
1. Dry Locations:
   a. All those indoor areas which do not fall within the definition below for Wet Locations and which are not otherwise designated on the Drawings.
2. Wet Locations:
   a. All locations exposed to the weather or contact with water (such as kitchen areas subject to directional water spray as a means of cleaning surfaces), whether under a roof or not, unless otherwise designated on the Drawings.

1.08 SAFETY AND INDEMNITY:

A Lock out Requirements:
1. Provide disconnecting means capable of being locked out for machines and other equipment to prevent unexpected startup or release of stored energy in accordance with 29 CFR 1910.147

B The Contractor is solely and completely responsible for conditions of the job site including safety of all persons and properly during performance of the work. This requirement will apply continually and not be limited to normal working hours.
1. No act, service, drawing review or construction review by the Owner, the Engineer or their Consultants is intended to include reviews of the adequacy of the Contractors safety measures in or near the construction site.
2. The Contractor performing work under this Division of the Specifications shall hold harmless, indemnify, and defend the Owner, the Engineer, their consultants, and each of their officers, agents and employees from any and all liability claims, losses, or damage arising out of or alleged to arise from bodily injury, sickness, or death of a person or persons

and for all damages arising out of injury to or destruction of property arising directly or indirectly out of or in connection with the performance of the work under this Division of the Specifications, and from the Contractor's negligence in the performance of the work described in the construction contract documents, but not including liability that may be due to the sole negligence of the Owner, the Engineer, their Consultants or their officers, agents and employees.

PART 2 PRODUCTS

2.01 STANDARD OF QUALITY:

A Material and Equipment: Provide materials and equipment that are new and are current products of manufacturers regularly engaged in the production of such products. The standard products shall have been in satisfactory commercial or industrial use for two years prior to bid opening. The two-year period includes use of equipment and materials of similar size under similar circumstances. For uniformity, only one manufacturer will be accepted for each type of product.

B Service Support: Submit a certified list of qualified permanent service organizations including their addresses and qualification for support of the equipment. These service organizations shall be convenient to the equipment installation and able to render service to the equipment on a regular and emergency basis during the warranty period of the contract.

C Manufacturer's Recommendations: Where installation procedures are required to be in accordance with manufacturer's recommendations, furnish printed copies of the recommendations prior to installation. Installation of the item shall not proceed until recommendations are received. Failure to furnish recommendation shall be cause for rejection of the equipment or material.

2.02 FASTENERS:

A Fasteners for securing equipment to walls, floors and the like shall be either hot-dip galvanized after fabrication or stainless steel.

2.03 FINISH REQUIREMENTS:

A Equipment: Refer to each electrical equipment section of these Specifications for painting requirements of equipment enclosures. Repair any final paint finish which has been damaged or is otherwise unsatisfactory, to the satisfaction of the Engineer.

B In finished areas, paint all exposed conduits, boxes and fittings to match the color of the surface to which they are affixed.

PART 3 EXECUTION

3.01 PRE-CONSTRUCTION SITE WALK

A Prior to commencing work, the contractor shall perform a pre-construction site walk and shall make note of any existing deficiencies of the electrical/low voltage systems, damage to electrical/low voltage systems, or malfunctioning electrical/low voltage equipment. Provide the Engineer with a written list of deficiencies found prior to commencing work.

3.02 INSTALLATION:

A Ensure that all equipment and materials fit properly in their installation.

B Perform any required work to correct improperly fit installation at no additional expense to the Owner.

C Equipment Installation:

1. Provide the required inserts, bolts and anchors, and securely attach all equipment and materials to their supports.
2. In all rooms with concrete floors, install all floor mounted equipment on reinforced concrete pads as shown. Insure that pads are seismically secured to the building structure. The Contractor, suppliers, and fabricators shall take this requirement into consideration when designing, fabricating, and installing panels and other enclosures so that height above the floor of the operating handles of electrical devices meets the requirements of these Specifications and applicable codes.
3. Mount all metal panels which are mounted on or abutting concrete walls or any outside walls a minimum of ¼ inch from the wall, and paint the back sides of the panels with Bituminous Coating, Rust-oleum C9578 Coal Tar Epoxy Coating or approved equal. Film thickness shall be 10 mils minimum.

D Cutting, Drilling and Welding:

1. Provide the required cutting, drilling welding that is required for the electrical construction work. Comply with Division 1 requirements.
2. Structural members shall not be cut or drilled, except after approval by the Engineer. Use a core drill wherever it is necessary to drill through concrete or masonry.
3. Provide the required welding for equipment supports. Conduits and fittings shall not be welded to structural steel. Where welding is required, it shall be accomplished by tradesmen certified to do such work. Provide fire and other protection as appropriate.

3.03 FIELD TESTS:

A Test shall be in accordance with Acceptance Testing specifications issued by the National Electrical Testing Association (NETA).

B Perform equipment field tests and adjustments. Properly calibrate, adjust and operationally check all circuits and components, and demonstrate as ready for service. Perform each operational check three times to ensure the circuit and components are working properly. Make additional calibration and adjustments if it is determined later that the initial adjustments are not satisfactory for proper performance. Perform equipment field test for equipment where equipment field tests are specified in the equipment Specifications. Give sufficient notice to the Engineer prior to any test so that the tests may be witnessed.

C Provide instruments, other equipment, temporary facilities as may be necessary, and material required for the tests. These shall be of the type designed for the type of tests to be performed and shall be calibrated by a recognized testing laboratory within three months prior to testing.

D Operational Tests: Operationally test all circuits to demonstrate that the circuits and equipment have been properly installed and adjusted and are ready for full-time service. Demonstrate the proper functioning of circuits in all modes of operation, including alarm conditions.

E Re-testing will be required for all unsatisfactory tests after the equipment or system has been repaired. Re-test all related equipment and systems if required by the Engineer. Repair and re-test equipment and systems which have been satisfactorily tested but later fail, until satisfactory performance is obtained.

F Perform calibration and adjustment on all equipment. Where the values for adjustment are not shown on the Drawings, obtain the proper values from the Engineer.

G Maintain records of each test and submit five copies to the Engineer when testing is complete. All tests shall be witnessed by the Owner and/or Engineer at their discretion. These records shall include:
1. Name of equipment tested.
2. Date of report.
3. Date of test.
4. Description of test setup.
5. Identification and rating of test equipment.
6. Test results and data.
7. Name of person performing test.
8. Owner or Engineer's initials.

H Items requiring testing as a minimum:
1. Circuit Breakers.

3.04 PAINTING OF EQUIPMENT:

A Factory Applied: Electrical equipment shall have factory applied painting system which shall, as a minimum, meet the requirements of NEMA ICS 6 corrosion-resistance test and the additional requirements specified in the technical section.

B Field Applied: Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria.

3.05 RECORDS:

A Maintain one copy of the contract Drawing Sheets on the site of the work for recording the record "as built" condition. After completion of the work, the Contractor shall neatly and carefully mark the work as actually constructed, revising, deleting and adding to the Drawing Sheets as required. The following requirements shall be complied with:
1. Drawings and associated as-built changes shall be completed in AutoCAD or Revit and submitted in CAD/Revit as well as PDF format. Documents with hand-written changes or with RFI responses and field sketches pasted on shall not be acceptable. Engineer shall make digital backgrounds of original contract documents available for Contractor's use upon request.
2. Cable Size and Type: Provide the size and type of each cable installed on the project.
3. Substructure: Where the location of duct lines, adjacent utilities, cable boxes, and manholes are found to different than shown, carefully mark the correct location on the Drawings. Work shall be dimensioned from existing improvements.
4. Record (As Built) Drawings: At the completion of the Work the Contractor shall provide a set of record "as built" drawings over to the Owner for his use.
   a. Record drawings are required to be transmitted within 30 days of beneficial occupancy.
   b. Transmittal and approval process:
      1) Contractor is to transmit one digital copy for review and comment.
      2) After acceptance of the above, the Contractor is to transmit three printed sets and one digital reproducible set.
      3) Contractor to provide information on their company in the margin of record drawings along with the date of the revisions and the associated revision number.

3.06 POSTED OPERATING INSTRUCTIONS:

A Provide for each system and principal item of equipment as specified in the technical sections for use by operation and maintenance personnel. The operating instructions shall include the following:

1. Single line diagrams, wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment at each major piece of distribution equipment.
2. Start up, proper adjustments, operating, lubrication and shutdown procedures.
3. Safety precautions.
4. The procedure in the event of equipment failure.
5. Other items of instruction as recommended by the manufacturer of each system or item of equipment.

B Instruction to Owner's Personnel:

1. Where specified in the technical sections, furnish the services of competent instructors to give full instruction to designated personnel in the adjustment, operation and maintenance of the specified systems and equipment, including pertinent safety requirements as required. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or systems has been accepted and turned over to the Owner for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the individual section. When more than 4 man-days of instruction are specified, use approximately half of the time for classroom instruction. Use other time for field instruction with equipment or system. When significant changes or modifications in the equipment or system are made under the terms of the contract, provide additional instructions to acquaint the operating personnel with the changes or modifications.
2. Contractor shall video record all training sessions and shall provide the Owner with a copy of the recording at the conclusion of the training. Recording shall be in digital video format (MP4, AVI, or similar) and shall be provided on USB stick or DVD labeled with the Contractor's contact information, the training topic, and date of training.
3. Contractor shall maintain an attendance sheet from each session which contains the following information:
   a. Attendees with associated arrival and departure time.
   b. Topics covered.
   c. Information provided.
   d. Signatures of attendees taken at the completion of the session.

3.07 CLEAN UP:

A Thoroughly clean all soiled surfaces of installed equipment and materials, including, but not limited to, removal of all dirt, dust, debris, and unused construction materials.

B Upon completion of electrical work, remove all surplus materials, rubbish, and debris that accumulated during the construction work. Leave the entire area neat, clean, and acceptable to the Engineer.

END OF SECTION

SECTION 26 05 05
SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A Electrical demolition.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

A Verify that abandoned wiring and equipment serve only abandoned facilities.

B Demolition drawings are based on casual field observation and existing record documents.

C Report discrepancies to Architect before disturbing existing installation.

D Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

A Disconnect electrical systems in walls, floors, and ceilings to be removed.

B Coordinate utility service outages with utility company.

C Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D 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. Minimize outage duration.

1. Obtain permission from Owner at least 24 hours before partially or completely disabling system.
2. Make temporary connections to maintain service in areas adjacent to work area.

E Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Minimize outage duration.

1. Notify Owner before partially or completely disabling system.
2. Notify local fire service.
3. Make notifications at least 24 hours in advance.
4. Make temporary connections to maintain service in areas adjacent to work area.

F 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. Minimize outage duration.

1. Notify Owner at least 24 hours before partially or completely disabling system.
2. Notify telephone utility company at least 24 hours before partially or completely disabling system.
3. Make temporary connections to maintain service in areas adjacent to work area.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with applicable

federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:

1. PCB-containing electrical equipment, including transformers, capacitors, and switches.
2. PCB- and DEHP-containing lighting ballasts.
3. Mercury-containing lamps and tubes, including fluorescent lamps, high intensity discharge (HID), arc lamps, ultra-violet, high pressure sodium, mercury vapor, ignitron tubes, neon, and incandescent.

B Remove, relocate, and extend existing installations to accommodate new construction.

C Remove abandoned wiring to source of supply.

D Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

E Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

F Disconnect and remove abandoned panelboards and distribution equipment.

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 Repair adjacent construction and finishes damaged during demolition and extension work.

J Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

K Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.04 CLEANING AND REPAIR

A See Section 01 74 19 - Construction Waste Management and Disposal for additional requirements.

B Clean and repair existing materials and equipment that remain or that are to be reused.

C Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

D Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts and broken electrical parts.

END OF SECTION

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A Single conductor building wire.
B Underground feeder and branch-circuit cable.
C Service entrance cable.
D Wiring connectors.
E Electrical tape.
F Heat shrink tubing.
G Oxide inhibiting compound.
H Wire pulling lubricant.
I Cable ties.
J Firestop sleeves.

1.02 RELATED REQUIREMENTS

A Section 26 05 26 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
B Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2018).
B ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011 (Reapproved 2017).
C ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010, with Editorial Revision (2020).
D ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2020).
E ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2017.
F ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2020.
G NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
H NECA 121 - Standard for Installing Nonmetallic-Sheathed Cable (Type NM-B) and Underground Feeder and Branch-Circuit Cable (Type UF); 2007.
I NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.
J NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.
K NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
L UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.
M UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

N UL 267 - Outline of Investigation for Wire-Pulling Compounds; Most Recent Edition, Including All Revisions.

O UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

P UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

Q UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

R UL 493 - Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables; Current Edition, Including All Revisions.

S UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

T UL 854 - Service-Entrance Cables; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A Coordination:

1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

B Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

C Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

1.06 QUALITY ASSURANCE

A Comply with requirements of NFPA 70.

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

C Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C Nonmetallic-sheathed cable is not permitted.

D Armored cable is not permitted.

E Metal-clad cable is not permitted.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A Provide products that comply with requirements of NFPA 70.

B Provide products listed, classified, and labeled as suitable for the purpose intended.

C Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D Comply with NEMA WC 70.

E Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G Conductors for Grounding and Bonding: Also comply with Section 26 05 26.

H Conductor Material:

1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
3. Tinned Copper Conductors: Comply with ASTM B33.

I Minimum Conductor Size:

1. Branch Circuits: 12 AWG.
   a. Exceptions:
      1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
      2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
      3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
2. Control Circuits: 14 AWG.

J Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

K Conductor Color Coding:

1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
2. Color Coding Method: Integrally colored insulation.
   a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
3. Color Code:
   a. 208Y/120 V, 3 Phase, 4 Wire System:
      1) Phase A: Black.

2) Phase B: Red.
3) Phase C: Blue.
4) Neutral/Grounded: White.

b. Equipment Ground, All Systems: Green.
c. For control circuits, comply with manufacturer's recommended color code.

2.03 SINGLE CONDUCTOR BUILDING WIRE

A Manufacturers:
1. Copper Building Wire:
a. Cerro Wire LLC: www.cerrowire.com/#sle.
b. General Cable Technologies Corporation; _____: www.generalcable.com/#sle.
c. Southwire Company: www.southwire.com/#sle.

B Description: Single conductor insulated wire.

C Conductor Stranding:
1. Feeders and Branch Circuits:
a. Size 10 AWG and Smaller: Solid.
b. Size 8 AWG and Larger: Stranded.

D Insulation Voltage Rating: 600 V.

E Insulation:
1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
a. Size 6 AWG and Larger: Type XHHW-2.
b. Installed Underground: Type XHHW-2.
c. Fixture Wiring Within Luminaires: Type TFFN/TFN for luminaires with labeled maximum temperature of 90 degrees C; Approved suitable type for luminaires with labeled maximum temperature greater than 90 degrees C.

2.04 UNDERGROUND FEEDER AND BRANCH-CIRCUIT CABLE

A Manufacturers:
1. Southwire Company: www.southwire.com/#sle.

B Description: NFPA 70, Type UF multiple-conductor cable listed and labeled as complying with UL 493, Type UF-B.

C Provide equipment grounding conductor unless otherwise indicated.

D Conductor Stranding:
1. Size 10 AWG and Smaller: Solid.
2. Size 8 AWG and Larger: Stranded.

E Insulation Voltage Rating: 600 V.

2.05 SERVICE ENTRANCE CABLE

A Manufacturers:
1. Copper Service Entrance Cable:
a. Cerro Wire LLC: www.cerrowire.com/#sle.
b. Encore Wire Corporation: www.encorewire.com/#sle.
c. Southwire Company: www.southwire.com/#sle.

B Service Entrance Cable for Above-Ground Use: NFPA 70, Type SE multiple-conductor cable listed and labeled as complying with UL 854, Style R.

C Service Entrance Cable for Underground Use: NFPA 70, Type USE single-conductor cable listed and labeled as complying with UL 854, Type USE-2, and with UL 44 Type RHH/RHW-2.

D Conductor Stranding: Stranded.

E Insulation Voltage Rating: 600 V.

2.06 WIRING CONNECTORS

A Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B Connectors for Grounding and Bonding: Comply with Section 26 05 26.

C Wiring Connectors for Splices and Taps:

1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors.

D Wiring Connectors for Terminations:

1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
2. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
3. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
4. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors where connectors are required.
5. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
6. Conductors for Control Circuits: Use crimped terminals for all connections.

E Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

F Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

G Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.

1. Manufacturers:
   a. 3M: www.3m.com/#sle.
   b. Ideal Industries, Inc: www.idealindustries.com/#sle.
   c. NSI Industries LLC: www.nsiindustries.com/#sle.

H Mechanical Connectors: Provide bolted type or set-screw type.

1. Manufacturers:
   a. Burndy LLC; _____: www.burndy.com/#sle.
   b. Ilsco: www.ilsco.com/#sle.
   c. Thomas & Betts Corporation: www.tnb.com/#sle.

I Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

1. Manufacturers:

a. Burndy LLC; _____: www.burndy.com/#sle.
b. Ilsco: www.ilsco.com/#sle.
c. Thomas & Betts Corporation: www.tnb.com/#sle.

2.07 ACCESSORIES

A Electrical Tape:
1. Manufacturers:
   a. 3M: www.3m.com/#sle.
2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
5. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.
6. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.

B Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
1. Manufacturers:
   a. 3M: www.3m.com/#sle.
   b. Burndy LLC; _____: www.burndy.com/#sle.
   c. Thomas & Betts Corporation: www.tnb.com/#sle.

C Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
1. Manufacturers:
   a. Burndy LLC; _____: www.burndy.com/#sle.
   b. Ideal Industries, Inc: www.idealindustries.com/#sle.
   c. Ilsco: www.ilsco.com/#sle.

D Wire Pulling Lubricant:
1. Manufacturers:
   a. 3M: www.3m.com/#sle.
   b. American Polywater Corporation: www.polywater.com/#sle.
   c. Ideal Industries, Inc: www.idealindustries.com/#sle.
2. Listed and labeled as complying with UL 267.
3. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
4. Suitable for use at installation temperature.

E Cable Ties: Material and tensile strength rating suitable for application.
1. Manufacturers:
   a. Burndy LLC; _____: www.burndy.com/#sle.

F Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for cables and roofing system to be installed; designed to accommodate existing penetrations where applicable.
   1. Products:
      a. Menzies Metal Products; Electrical Roof Stack and Cap: www.menzies-metal.com/#sle.
      b. Menzies Metal Products; Electrical Retro Box: www.menzies-metal.com/#sle.

G Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.
   1. Products:
      a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built: www.holdrite.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A Verify that interior of building has been protected from weather.

B Verify that work likely to damage wire and cable has been completed.

C Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D Verify that field measurements are as indicated.

E Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

A Circuiting Requirements:
   1. Unless dimensioned, circuit routing indicated is diagrammatic.
   2. When circuit destination is indicated without specific routing, determine exact routing required.
   3. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
   4. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
   5. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
   6. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.

B Install products in accordance with manufacturer's instructions.

C Perform work in accordance with NECA 1 (general workmanship).

D Install underground feeder and branch-circuit cable (Type UF-B) in accordance with NECA 121.

E Installation in Raceway:
   1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.

2. Pull all conductors and cables together into raceway at same time.
3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

F Exposed Cable Installation (only where specifically permitted):
1. Route cables parallel or perpendicular to building structural members and surfaces.
2. Protect cables from physical damage.

G Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

H Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.

I Terminate cables using suitable fittings.

J Install conductors with a minimum of 12 inches of slack at each outlet.

K Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

L Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

M Make wiring connections using specified wiring connectors.
1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
3. Do not remove conductor strands to facilitate insertion into connector.
4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.

N Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
   a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.

a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.

O Insulate ends of spare conductors using vinyl insulating electrical tape.

P Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

Q Identify conductors and cables in accordance with Section 26 05 53.

R Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

S Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.04 FIELD QUALITY CONTROL

A See Section 01 40 00 - Quality Requirements, for additional requirements.

B Inspect and test in accordance with NETA ATS, except Section 4.

C Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.

1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

D Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A Grounding and bonding requirements.
B Conductors for grounding and bonding.
C Connectors for grounding and bonding.
D Ground bars.
E Ground rod electrodes.
F Ground plate electrodes.
G Ground access wells.

1.02 RELATED REQUIREMENTS

A Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
B Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2012.
B NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
C NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.
D NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
E UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A Coordination:
1. Verify exact locations of underground metal water service pipe entrances to building.
2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.
B Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
C Field quality control test reports.
D Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.06 QUALITY ASSURANCE

A Comply with requirements of NFPA 70.

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

C Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.

B Do not use products for applications other than as permitted by NFPA 70 and product listing.

C Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

D Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

E Grounding System Resistance:

1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.

F Grounding Electrode System:

1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
   a. Provide continuous grounding electrode conductors without splice or joint.
   b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
2. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
3. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
   a. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
   b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.

c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

G Service-Supplied System Grounding:

1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.

H Bonding and Equipment Grounding:

1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
   a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
   b. Metal gas piping.
8. Provide bonding for metal building frame.

I Communications Systems Grounding and Bonding:

1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
   a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
   b. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
   c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

2.02 GROUNDING AND BONDING COMPONENTS

A General Requirements:
1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.

B Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 05 26:
1. Use insulated copper conductors unless otherwise indicated.
   a. Exceptions:
      1) Use bare copper conductors where installed underground in direct contact with earth.
      2) Use bare copper conductors where directly encased in concrete (not in raceway).

C Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
3. Unless otherwise indicated, use exothermic welded connections for accessible connections.
4. Manufacturers - Exothermic Welded Connections:

D Ground Bars:
1. Description: Copper rectangular ground bars with mounting brackets and insulators.
2. Size: As indicated.
3. Holes for Connections: As indicated or as required for connections to be made.
4. Manufacturers:

PART 3 EXECUTION

3.01 EXAMINATION

A Verify that work likely to damage grounding and bonding system components has been completed.

B Verify that field measurements are as indicated.

C Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A Install products in accordance with manufacturer's instructions.

B Perform work in accordance with NECA 1 (general workmanship).

C Make grounding and bonding connections using specified connectors.
1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

D Identify grounding and bonding system components in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

A See Section 01 40 00 - Quality Requirements, for additional requirements.

B Inspect and test in accordance with NETA ATS except Section 4.

C Perform inspections and tests listed in NETA ATS, Section 7.13.

D Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

E Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

F Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

A Section 26 05 33.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

B Section 26 05 33.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.

C Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.

D Section 26 51 00 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

E Section 26 56 00 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

1.03 REFERENCE STANDARDS

A ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2019.

D MFMA-4 - Metal Framing Standards Publication; 2004.

E NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

F NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A Coordination:

1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
2. Coordinate work to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has cured; see Section 03 30 00.

1.05 SUBMITTALS

A Product Data: Provide manufacturer's standard catalog pages and data sheets for channel/strut framing systems, nonpenetrating rooftop supports, and post-installed concrete/masonry anchors.

B Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

C Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

A Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A General Requirements:

1. Comply with the following. Where requirements differ, comply with most stringent.
   a. NFPA 70.
   b. Requirements of authorities having jurisdiction.
2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for load to be supported with minimum safety factor of 2. Include consideration for vibration, equipment operation, and shock loads where applicable.
5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
6. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
7. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
   a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
   b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
   c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
   d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B Components for Vibration Isolation and/or Seismic Controls: See Section 26 05 48.

C Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.

1. Manufacturers:

a. ABB: www.electrification.us.abb.com/#sle.
b. Eaton Corporation: www.eaton.com/#sle.
c. nVent; Caddy: www.nvent.com/#sle.

2. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
3. Conduit Clamps: Bolted type unless otherwise indicated.

D Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.

1. Manufacturers:
   a. ABB: www.electrification.us.abb.com/#sle.
   b. Eaton Corporation: www.eaton.com/#sle.
   c. nVent; Caddy: www.nvent.com/#sle.

E Metal Channel/Strut Framing Systems:

1. Manufacturers:
   a. ABB: www.electrification.us.abb.com/#sle.
   b. Atkore International Inc; Unistrut: www.unistrut.us/#sle.
2. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
3. Comply with MFMA-4.
4. Channel/Strut Used as Raceway, Where Indicated: Listed and labeled as complying with UL 5B.
5. Channel Material:
   a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
   b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
6. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch.
7. Minimum Channel Dimensions: 1-5/8 inch wide by 13/16 inch high.

F Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.

1. Minimum Size, Unless Otherwise Indicated or Required:
   a. Equipment Supports: 1/2-inch diameter.
   b. Single Conduit up to 1-inch (27 mm) Trade Size: 3/8-inch diameter.
   c. Single Conduit Larger than 1-inch (27 mm) Trade Size: 1/2-inch diameter.
   d. Trapeze Support for Multiple Conduits: 3/8-inch diameter.
   e. Outlet Boxes: 3/8-inch diameter.
   f. Luminaires: 3/8-inch diameter.
   g. Rod Stiffeners: Maximum rod length permitted without stiffeners shall be 18". Provide rod stiffener every 28" along length of rod.

G Nonpenetrating Rooftop Supports for Low-Slope Roofs:

1. Manufacturers:
   a. Atkore International Inc; Unistrut: www.unistrut.us/#sle.
   b. Eaton Corporation: www.eaton.com/#sle.
   c. nVent; Caddy: www.nvent.com/#sle.
2. Description: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring attachment to roof structure and not penetrating roofing assembly, with support fixtures as specified.

3. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
4. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
5. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.

H Anchors and Fasteners:

1. Manufacturers - Mechanical Anchors:
   a. Dewalt: anchors.dewalt.com/#sle.
   b. Hilti, Inc: www.hilti.com/#sle.
   c. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.
2. Manufacturers - Powder-Actuated Fastening Systems:
   a. Dewalt: anchors.dewalt.com/#sle.
   b. Hilti, Inc: www.hilti.com/#sle.
   c. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.
3. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
4. Concrete: Use preset concrete inserts or expansion anchors.
5. Solid or Grout-Filled Masonry: Use expansion anchors.
6. Hollow Masonry: Use toggle bolts.
7. Hollow Stud Walls: Use toggle bolts.
8. Steel: Use beam clamps, machine bolts, or welded threaded studs.
9. Sheet Metal: Use sheet metal screws.
10. Wood: Use wood screws.
11. Plastic and lead anchors are not permitted.
12. Powder-actuated fasteners are not permitted.
13. Hammer-driven anchors and fasteners are not permitted.
14. Preset Concrete Inserts: Continuous metal channel/strut and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    a. Manufacturer: Same as manufacturer of metal channel/strut framing system.
    b. Comply with MFMA-4.
    c. Channel Material: Use galvanized steel.
15. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

PART 3 EXECUTION

3.01 EXAMINATION

A Verify that field measurements are as indicated.

B Verify that mounting surfaces are ready to receive support and attachment components.

C Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A Install products in accordance with manufacturer's instructions.

B Install hangers and supports in accordance with NECA 1.

C Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

D Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

E Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

F Unless specifically indicated or approved by Architect, do not provide support from roof deck.

G Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

H Provide required vibration isolation and/or seismic controls; see Section 26 05 48.

I Equipment Support and Attachment:

1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.
2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

J Conduit Support and Attachment: See Section 26 05 33.13 for additional requirements.

K Box Support and Attachment: See Section 26 05 33.16 for additional requirements.

L Interior Luminaire Support and Attachment: See Section 26 51 00 for additional requirements.

M Exterior Luminaire Support and Attachment: See Section 26 56 00 for additional requirements.

N Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

O Secure fasteners in accordance with manufacturer's recommended torque settings.

P Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A See Section 01 40 00 - Quality Requirements for additional requirements.

B Inspect support and attachment components for damage and defects.

C Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 26 05 33.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A Galvanized steel rigid metal conduit (RMC).
B Flexible metal conduit (FMC).
C Liquidtight flexible metal conduit (LFMC).
D Galvanized steel electrical metallic tubing (EMT).
E Rigid polyvinyl chloride (PVC) conduit.
F High-density polyethylene (HDPE) conduit.

1.02 RELATED REQUIREMENTS

A Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Cable assemblies consisting of conductors protected by integral metal armor.
B Section 26 05 26 - Grounding and Bonding for Electrical Systems.
1. Includes additional requirements for fittings for grounding and bonding.
C Section 26 05 29 - Hangers and Supports for Electrical Systems.
D Section 26 05 33.16 - Boxes for Electrical Systems.
E Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
F Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
G Section 26 21 00 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.
H Section 27 05 33.13 - Conduit for Communications Systems.

1.03 REFERENCE STANDARDS

A ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.
B ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.
C ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit; 2018.
D ASTM D1002 - Standard Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal); 2010 (Reapproved 2019).
E ASTM D1598 - Standard Test Methods for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure; 2021.
F ASTM D1599 - Standard Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings; 2018.
G ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing; 2020.
H ASTM D3261 - Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing; 2016.
I ASTM F1055 - Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing; 2016a (Reapproved 2022).

J ASTM F2160 - Standard Specification for Solid Wall High Density Polyethylene (HDPE) Conduit Based on Controlled Outside Diameter (OD); 2016.

K ASTM F2176 - Standard Specification for Mechanical Couplings Used on Polyethylene Conduit, Duct and Innerduct; 2017.

L NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

M NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.

N NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2017.

O NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

P NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.

Q NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.

R NEMA TC 7 - Solid-Wall Coilable and Straight Electrical Polyethylene Conduit; 2021.

S NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

T UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

U UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

V UL 360 - Liquid-Tight Flexible Metal Conduit; Current Edition, Including All Revisions.

W UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

X UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

Y UL 651A - High Density Polyethylene (HDPE) Conduit; Current Edition, Including All Revisions.

Z UL 746C - Polymeric Materials – Use in Electrical Equipment Evaluations; Current Edition, Including All Revisions.

AA UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

BB UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

CC UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

DD UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A Coordination:

1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B Sequencing:

1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

1.05 SUBMITTALS

A Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

B Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2-inch (53 mm) trade size and larger.

1.06 QUALITY ASSURANCE

A Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

A Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.

B Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.

C Underground:

1. Under Slab on Grade: Use rigid PVC conduit.
2. Exterior, Direct-Buried: Use rigid PVC conduit or HDPE.
3. Exterior, Embedded Within Concrete: Use rigid PVC conduit.
4. Where rigid polyvinyl chloride (PVC) conduit or high-density polyethylene (HDPE) conduit is provided, transition to galvanized steel rigid metal conduit (RMC) where emerging from underground.
5. Where rigid polyvinyl (PVC) conduit larger than 2-inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit (RMC) elbows for bends.
6. Where galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC) is installed in direct contact with earth, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection.
7. Where steel conduit emerges from concrete into soil, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches on either side of where conduit emerges.

D Embedded Within Concrete:

1. Within Slab on Grade (within structural slabs only where approved by Structural Engineer) : Use rigid PVC conduit.
2. Within Slab Above Ground (within structural slabs only where approved by Structural Engineer): Use rigid PVC conduit.
3. Within Concrete Walls Above Ground: Use rigid PVC conduit.

4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC) where emerging from concrete.
5. Where galvanized steel electrical metallic tubing (EMT) or galvanized steel rigid metal conduit (RMC) emerges from concrete into salt air, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection for minimum of 4 inches on either side of where conduit emerges.

E Concealed Within Hollow Masonry Walls: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).

F Concealed Within Hollow Stud Walls: Use electrical metallic tubing (EMT).

G Concealed Above Accessible Ceilings: Use electrical metallic tubing (EMT).

H Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit (RMC).

I Exposed, Interior, Not Subject to Physical Damage: Use electrical metallic tubing (EMT).

J Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit.

1. Locations subject to physical damage include, but are not limited to:
   a. Where exposed below 8 feet, except within electrical and communication rooms or closets.
   b. Where exposed below 20 feet in warehouse areas.

K Exposed, Exterior: Use galvanized steel rigid metal conduit.

L Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).

M Flexible Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit (FMC).

1. Maximum Length: 6 feet.

N Flexible Connections to Vibrating Equipment:

1. Dry Locations: Use flexible metal conduit (FMC).
2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC).
3. Maximum Length: 6 feet unless otherwise indicated.
4. Vibrating equipment includes, but is not limited to:
   a. Transformers.
   b. Motors.

2.02 CONDUIT - GENERAL REQUIREMENTS

A Comply with NFPA 70.

B Electrical Service Conduits: See Section 26 21 00 for additional requirements.

C Fittings for Grounding and Bonding: See Section 26 05 26 for additional requirements.

D Provide conduit, fittings, supports, and accessories required for complete raceway system.

E Provide products listed, classified, and labeled as suitable for purpose intended.

F Minimum Conduit Size, Unless Otherwise Indicated:

1. Branch Circuits: 3/4 inch (21 mm) trade size.
2. Underground, Interior: 1 inch (27 mm) trade size.
3. Underground, Exterior: 1-inch trade size.

G Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A Manufacturers:
1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
2. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
3. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.

B Conduit with integral fittings, such as Allied Tube and Conduit's "Kwik-Couple" are not permitted.

C Interior conduits shall be color-coded based on the wiring or system type they serve. Paint shall be factory applied by the manufacturer
1. Normal Power Systems: No color
2. Emergency and Standby Power Systems: Yellow
3. Fire Alarm: Red
4. Security: Orange
5. Telephone and Data: Blue
6. Audio/Visual: Purple
7. Other Low Voltage: Green

D Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

E Fittings:
1. Manufacturers:
   a. ABB; T&B: www.electrification.us.abb.com/#sle.
   b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.
   c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
4. Material: Use steel or malleable iron.
   a. Do not use die cast zinc fittings.
5. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.04 FLEXIBLE METAL CONDUIT (FMC)

A Manufacturers:
1. AFC Cable Systems, a division of Atkore International: www.afcweb.com/#sle.

B Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.

C Fittings:
1. Manufacturers:
   a. ABB; T&B: www.electrification.us.abb.com/#sle.
   b. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.

a. Do not use die cast zinc fittings.

2.05 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A Manufacturers:
1. AFC Cable Systems, a division of Atkore International: www.afcweb.com/#sle.

B Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

C Fittings:
1. Manufacturers:
   a. ABB; T&B: www.electrification.us.abb.com/#sle.
   b. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
   a. Do not use die cast zinc fittings.

2.06 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

A Manufacturers:
1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
2. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
3. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.

B Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C Conduits with integral fittings similar to Allied Tube & Conduit's "Kwik-Fit" shall not be used.

D Interior conduits shall be color-coded based on the wiring or system type they serve. Paint shall be factory applied by the manufacturer
1. Normal Power Systems: No color
2. Emergency and Standby Power Systems: Yellow
3. Fire Alarm: Red
4. Security: Orange
5. Telephone and Data: Blue
6. Audio/Visual: Purple
7. Other Low Voltage: Green

E Fittings:
1. Manufacturers:
   a. ABB; T&B: www.electrification.us.abb.com/#sle.
   b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.
   c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
   a. Do not use die cast zinc fittings.
4. Connectors and Couplings: Use compression/gland or set-screw type.
   a. Do not use indenter type connectors and couplings.

2.07 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A Manufacturers:
1. ABB; Carlon: www.carlon.com/#sle.
2. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
3. Cantex Inc: www.cantexinc.com/#sle.

B Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

C Fittings:
1. Expansion fittings similar to Carlon's "E945" series shall not be used.
2. Manufacturer: Same as manufacturer of conduit to be connected.
3. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.08 HIGH-DENSITY POLYETHYLENE (HDPE) CONDUIT

A Manufacturers:
1. ABB; Carlon: www.electrification.us.abb.com/#sle.
2. Blue Diamond Industries, LLC: www.bdiky.com/#sle.
3. Eastern Wire + Conduit, a division of Atkore International: www.easternwire.com/#sle.

B Description: NFPA 70, Type HDPE high-density polyethylene solid-wall conduit complying with ASTM F2160 and NEMA TC 7; list and label as complying with UL 651A; Schedule 40 unless otherwise indicated.

C Joining Methods: Approved by HDPE conduit manufacturer.

D Mechanical Fittings: Comply with ASTM F2176; list and label as complying with UL 651A.

E Butt Heat Fusion Fittings: Comply with ASTM D3261.

F Socket Fusion Fittings: Comply with ASTM D2683.

G Electrofusion Fittings: Comply with ASTM F1055.

2.09 ACCESSORIES

A Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch.

B Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.

C Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

D Adhesive for HDPE Conduit:
1. Specifically designed for bonding dissimilar materials in lieu of transition fittings, including but not limited to polyethylene, fiberglass, PVC, aluminum, and steel; UL 746C recognized.
2. Approved by adhesive manufacturer for use with materials to be joined.
3. Adhesive Shear Strength: Not less that 100 psi, when tested in accordance with ASTM D1002.
4. Hydrostatic Pressure Resistance: No leaks, when tested in accordance with ASTM D1598 at 120 psi for 1,000 hours and when tested in accordance with ASTM D1599 at 250 psi.
5. Products:
   a. American Polywater Corporation; Polywater BonDuit Conduit Adhesive: www.polywater.com/#sle.

E Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf.

F Foam Conduit Sealant:
1. Removable, two-part, closed-cell foam, specifically designed for sealing conduit openings against water, moisture, gases, and dust.
2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
3. Rated to hold minimum of 10 ft water head pressure.
4. Products:
   a. American Polywater Corporation; Polywater AFT Foam Duct Sealant: www.polywater.com/#sle.
   b. American Polywater Corporation; Polywater FST Foam Duct Sealant: www.polywater.com/#sle.

G Conduit Mechanical Seals:
1. Listed as complying with UL 514B.
2. Specifically designed for sealing conduit openings against water, moisture, gases, and dust.
3. Suitable for sealing around conductors/cables to be installed.
4. Products:
   a. American Polywater Corporation; PHRD SG Mechanical Seals: www.polywater-haufftechnik.com/#sle.

H Sealing Compound for Hazardous/Classified Location Sealing Fittings: Listed for use with particular fittings to be installed.

I Sealing Systems for Concrete Penetrations:
1. Sleeves: Provide water stop ring or cement coating that bonds to concrete to prevent water infiltration.
2. Rate for minimum of 40 psig; suitable for sealing around conduits to be installed.
3. Products:
   a. American Polywater Corporation; PZVR Cement-Coated Concrete Wall Sleeves: www.polywater-haufftechnik.com/#sle.
   b. American Polywater Corporation; PHSD Mechanical Seals: www.polywater-haufftechnik.com/#sle.
   c. American Polywater Corporation; PHSI 150 Varia Double Wall Inserts: www.polywater-haufftechnik.com/#sle.
   d. American Polywater Corporation; PGKD Modular Seals: www.polywater-haufftechnik.com/#sle.

J Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.
1. Products:
   a. Alta Products, LLC; Sigrist Pipe Chase Housing, Curbs, and Exit Seals: www.altaproductsllc.com/#sle.
   b. Menzies Metal Products; Electrical Roof Stack and Cap: www.menzies-metal.com/#sle.

c. Menzies Metal Products; Electrical Retro Box: www.menzies-metal.com/#sle.

K 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.

1. Products:
   a. Quickflash Weatherproofing Products, Inc: www.quickflashproducts.com/#sle.

L Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for conduit/duct arrangement to be installed.

1. Products:
   a. Advance Products & Systems, LLC; Duct Bank Spacers: www.apsonline.com/#sle

M Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

1. Products:
   a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built: www.holdrite.com/#sle.

N Bore Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for installation within casing; furnished with roller wheels to facilitate installation, openings to facilitate grout flow, and holes for stabilization cable; suitable for casing and conduit/duct arrangement to be installed.

1. Products:
   a. Advance Products & Systems, LLC; Bore Spacers: www.apsonline.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A Verify that field measurements are as indicated.

B Verify that mounting surfaces are ready to receive conduits.

C Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A Install products in accordance with manufacturer's instructions.

B Install conduit in accordance with NECA 1.

C Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D Install intermediate metal conduit (IMC) in accordance with NECA 101.

E Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

F Conduit Routing:

1. Unless dimensioned, conduit routing indicated is diagrammatic.
2. When conduit destination is indicated without specific routing, determine exact routing required.
3. Conceal conduits unless specifically indicated to be exposed.
4. Conduits in the following areas may be exposed, unless otherwise indicated:
   a. Electrical rooms.
   b. Mechanical equipment rooms.
   c. Within joists in areas with no ceiling.
5. Unless otherwise approved, do not route exposed conduits:
   a. Across floors.
   b. Across top of parapet walls.

c. Across building exterior surfaces.

6. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
7. Arrange conduit to maintain adequate headroom, clearances, and access.
8. For power conduits, arrange conduit to provide no more than the equivalent of three 90 degree bends between pull points.
9. For low voltage conduits, arrange conduit to provide no more than the equivalent of two 90 degree bends between pull points.
10. Arrange conduit to provide no more than 150 feet between pull points.
11. Route conduits above water and drain piping where possible.
12. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
13. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
14. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
    a. Heaters.
    b. Hot water piping.
    c. Flues.
15. Group parallel conduits in same area on common rack.

G Conduit Support:

1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 26 05 29.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
4. Use conduit strap to support single surface-mounted conduit.
    a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
5. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.
6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
7. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.
8. Use nonpenetrating rooftop supports to support conduits routed across rooftops, where approved.
9. Use of spring steel conduit clips for support of conduits is not permitted.
10. Use of wire for support of conduits is not permitted.
11. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with most stringent requirements.

H Connections and Terminations:

1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
7. Secure joints and connections to provide mechanical strength and electrical continuity.

I Penetrations:

1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
6. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
7. Provide metal escutcheon plates for conduit penetrations exposed to public view.
8. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 07 84 00.

J Underground Installation:

1. Provide trenching and backfilling; see Section 31 23 16.13.
2. Minimum Cover, Unless Otherwise Indicated or Required:
   a. Underground, Exterior: 18 inches.
   b. Under Slab on Grade: 12 inches to bottom of slab.

K Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):

1. Secure conduits to prevent floating or movement during pouring of concrete.

L Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:

1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
3. Where conduits are subject to earth movement by settlement or frost.

M Conduit Sealing:

1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
   a. Where conduits enter building from outside.
   b. Where service conduits enter building from underground distribution system.
   c. Where conduits enter building from underground.
   d. Where conduits may transport moisture to contact live parts.
2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:
   a. Where conduits pass from outdoors into conditioned interior spaces.
   b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
   c. Where conduits penetrate coolers or freezers.
3. Where conduits cross boundaries of hazardous/classified locations, provide identified/listed sealing fittings or conduit mechanical seals as approved by authorities having jurisdiction; locate as indicated or in accordance with NFPA 70.

N Provide pull string in each empty conduit and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

O Provide grounding and bonding; see Section 26 05 26.

P Identify conduits; see Section 26 05 53.

3.03 FIELD QUALITY CONTROL

A See Section 01 40 00 - Quality Requirements for additional requirements.

B Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

A Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION

A Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

SECTION 26 05 33.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

C Floor boxes.

D Underground boxes/enclosures.

E Accessories.

1.02 RELATED REQUIREMENTS

A Section 08 31 00 - Access Doors and Panels: Panels for maintaining access to concealed boxes.

B Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C Section 26 05 29 - Hangers and Supports for Electrical Systems.

D Section 26 05 33.13 - Conduit for Electrical Systems:

1. Conduit bodies and other fittings.
2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

E Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.

F Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

G Section 26 27 26 - Wiring Devices:

1. Wall plates.
2. Access floor boxes.

1.03 REFERENCE STANDARDS

A NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

E NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013 (Reaffirmed 2020).

F NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G SCTE 77 - Specifications for Underground Enclosure Integrity; 2017.

H UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

I UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

J UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

K UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, floor boxes, and underground boxes/enclosures.
1. Underground Boxes/Enclosures: Include reports for load testing in accordance with SCTE 77 certified by a professional engineer or an independent testing agency upon request.

B Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

C Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Keys for Lockable Enclosures: Two of each different key.

1.06 QUALITY ASSURANCE

A Comply with requirements of NFPA 70.

B Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 BOXES

A General Requirements:
1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled as suitable for the purpose intended.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:

1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit is used.
4. Use suitable concrete type boxes where flush-mounted in concrete.
5. Use suitable masonry type boxes where flush-mounted in masonry walls.
6. Use raised covers suitable for the type of wall construction and device configuration where required.
7. Use shallow boxes where required by the type of wall construction.
8. Do not use "through-wall" boxes designed for access from both sides of wall.
9. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
10. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
11. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
12. Gangable or sectional boxes shall not be permitted.
13. Minimum Box Size, Unless Otherwise Indicated:
    a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
    b. Communications Systems Outlets: 4 inch square by 2-1/8 inch (100 by 54 mm) trade size.
    c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
14. Wall Plates: Comply with Section 26 27 26.
15. Manufacturers:
    a. Hubbell Incorporated; RACO Products: www.hubbell-rtb.com/#sle.
    b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
    c. Thomas & Betts Corporation: www.tnb.com/#sle.

C Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:

1. Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA EN 10250 Environment Type, Unless Otherwise Indicated:
    a. Indoor Clean, Dry Locations: Type 1, painted steel.
    b. Outdoor Locations: Type 3R, painted steel.
3. Junction and Pull Boxes Larger Than 100 cubic inches:
    a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
   a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
6. Manufacturers:
   a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
   b. Hoffman, a brand of Pentair Technical Products: www.hoffmanonline.com/#sle.
   c. Hubbell Incorporated; Wiegmann Products: www.hubbell-wiegmann.com/#sle.

D Underground Boxes/Enclosures:
1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.
2. Size: As indicated on drawings.
3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches.
4. Provide logo on cover to indicate type of service. Covers shall read as follows for each system type:
   a. Power Systems: "ELECTRICAL"
   b. Site Lighting and/or Pole Lighting: "LIGHTING"
   c. Fire Alarm Systems: "FIRE ALARM"
   d. Other Low Voltage Systems: "COMMUNICATIONS"
   e. Utility: Per utility company requirements
5. Applications:
   a. Sidewalks/paved areas 6'-0" wide and smaller and Landscaped Areas Subject Only to Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 8 load rating.
   b. Parking Lots, Sidewalks/paved areas larger than 6'-0" wide, and in Areas Subject Only To Occasional Vehicular Traffic: Use reinforced concrete enclosures with galvanzed steel checker plate lids, with HS20-44 rating.
   c. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.
6. Polymer Concrete and Reinforced Concrete Underground Boxes/Enclosures: Comply with SCTE 77 and HS20-44.
   a. Manufacturers:
      1) Oldcastle Precast, Inc: www.oldcastleprecast.com/#sle.
   b. Combination fiberglass/polymer concrete boxes/enclosures are not acceptable. Use all-polymer concrete boxes/enclosures.

2.02 ACCESSORIES

A Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for boxes and facade materials to be installed.
1. Manufacturers:
   a. Quickflash Weatherproofing Products, Inc: www.quickflashproducts.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A Verify that field measurements are as indicated.

B Verify that mounting surfaces are ready to receive boxes.

C Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A Install products in accordance with manufacturer's instructions.

B Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D Provide separate boxes for emergency power and normal power systems.

E Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

H Box Locations:

1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 31 00 as required where approved by the Architect.
2. Unless dimensioned, box locations indicated are approximate.
3. Locate boxes so that wall plates do not span different building finishes.
4. Locate boxes so that wall plates do not cross masonry joints.
5. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
6. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
7. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
8. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
   a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
   b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
9. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 05 33.13.
10. Outlet boxes shall be installed at the locations and elevations shown on the drawings or specified herein. Make adjustments to locations as required by structural conditions and to suit coordination requirements of other trades.

11. Locate switch outlet boxes on the latch side of doorways unless otherwise indicated.
12. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
13. Outlet boxes shall not be installed back to back nor shall through-wall boxes be permitted.
14. For boxes mounted in exterior walls, make sure that there is insulation behind outlet boxes to prevent condensation in boxes.
15. For outlets mounted above counters, benches or backsplashes, coordinate location and mounting heights with built-in units. Adjust mounting height with required location for equipment served.
    a. Concealed above accessible suspended ceilings.
    b. Within joists in areas with no ceiling.
    c. Electrical rooms.
    d. Mechanical equipment rooms.

I Box Supports:
1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide required seismic controls in accordance with Section 26 05 48.
3. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
4. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
5. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.

J Install boxes plumb and level.

K Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

L Install boxes as required to preserve insulation integrity.

M Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.

N Underground Boxes/Enclosures:
1. Install enclosure on gravel base, minimum 6 inches deep.
2. Flush-mount enclosures located in concrete or paved areas.
3. Mount enclosures located in landscaped areas with top at 1 inch above finished grade.
4. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.

O Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

P Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

Q Close unused box openings.

R Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use. Leave no unused openings in any box. Install close-up plugs as required to seal all openings and removed knockouts.

S Provide grounding and bonding in accordance with Section 26 05 26.

T Identify boxes in accordance with Section 26 05 53.

3.03 CLEANING

A Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.04 PROTECTION

A Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

SECTION 26 05 33.23
SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A Surface raceway systems.

B Wireways.

1.02 RELATED REQUIREMENTS

A Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B Section 26 05 29 - Hangers and Supports for Electrical Systems.

C Section 26 05 33.13 - Conduit for Electrical Systems.

D Section 26 05 33.16 - Boxes for Electrical Systems.

E Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

F Section 26 27 26 - Wiring Devices: Receptacles.

1.03 REFERENCE STANDARDS

A NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D UL 5A - Nonmetallic Surface Raceways and Fittings; Current Edition, Including All Revisions.

E UL 870 - Wireways, Auxiliary Gutters, and Associated Fittings; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A Coordination:

1. Coordinate the placement of raceways with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate rough-in locations of outlet boxes provided under Section 26 05 33.16 and conduit provided under Section 26 05 33.13 as required for installation of raceways provided under this section.
3. Verify minimum sizes of raceways with the actual conductors and components to be installed.
4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B Sequencing:

1. Do not install raceways until final surface finishes and painting are complete.
2. Do not begin installation of conductors and cables until installation of raceways is complete between outlet, junction and splicing points.

1.05 SUBMITTALS

A Product Data: Provide manufacturer's standard catalog pages and data sheets including dimensions, knockout sizes and locations, materials, fabrication details, finishes, service condition requirements, and accessories.

1. Surface Raceway Systems: Include information on fill capacities for conductors and cables.

B Shop Drawings:

1. Pre-wired Surface Raceway Systems: Provide plan and elevation views including dimensioned locations of wiring devices and circuiting arrangements.
2. Wireways: Provide dimensioned plan and elevation views including adjacent equipment with all required clearances indicated.

C Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

A Comply with requirements of NFPA 70.

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

C Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 RACEWAY REQUIREMENTS

A Provide all components, fittings, supports, and accessories required for a complete raceway system.

B Provide products listed, classified, and labeled as suitable for the purpose intended.

C Do not use raceways for applications other than as permitted by NFPA 70 and product listing.

2.02 SURFACE RACEWAY SYSTEMS

A General:

1. Surface nonmetallic raceway is to be utilized in dry interior locations only as covered in Article 352 Part B of the National Electrical Code, as adopted by the National Fire Protection Association and as approved by the American National Standards Institute. The Raceway System shall be UL Listed under File Nos. E90378 Guide RJTX and E90377 Guide RJYT and CSA certified under File No. 350.
2. The raceway and all system components must be UL Listed and exhibit nonflammable self-extinguishing characteristics, tested to comparable specifications of UL 94V-0.

B Surface Nonmetallic Raceways: Listed and labeled as complying with UL 5A.

1. Single-Compartment Raceway:
   a. Raceway:
      1) The raceway base and cover shall be available in 5' lengths. The raceway base shall be available with and without adhesive tape backing. The system shall be manufactured of rigid PVC compound and have a smooth texture and white color.
      2) The raceway shall be a two-piece design with a base and a snap-on cover. Three sizes shall be available, with total width shall be 0.88" x 0.44", 1.32” x 0.44”, or 2.25” x 0.69” deep with a cross sectional area of 0.13 sq. in. The raceway base and cover sections shall have an approximate thickness of .06".
      3) A full compliment of fittings must be available including, but not limited to flat, internal, and external elbows, tees, cover clips, and end caps. The fittings shall

have a matte texture, available in ivory, white, and fog white colors to match the cover. They shall overlap the cover and base to hide uneven cuts. All fittings shall be supplied with a base where applicable to eliminate mitering. A transition fitting shall be available to adapt to other series raceways manufactured by the raceway manufacturer.

b. Devices and Fixture Boxes:
   1) Device boxes shall be available for mounting standard devices and faceplates. A device box shall be available in single-, two-, and three-gang configurations and range in depths from 0.88" to 2.75" for shallow and extra deep devices. Round fixture and extension boxes shall be available to mount fixtures and other devices with 3 1/2" or 4 1/16" mounting centers. Round fixture boxes shall be 1" D x 4.75" or 5.50" Dia. All device and fixture boxes shall be available in ivory, white, and fog white colors to match the raceway covers.

c. Communications Devices and Accessories:
   1) The raceway manufacturer will provide a complete line of connectivity outlets and modular inserts for UTP/STP, fiber optic coaxial and other cabling types with faceplates and bezels to facilitate mounting. A complete line of preprinted station and port identification labels, snap-in icon buttons, as well as write-on station identification labels shall be available.

d. Manufacturer:
   1) Panduit LD10WH8-A Surface Raceway Low Voltage Junction Box, White, district standard, no substitutions

2. Multi-Compartment Raceway:
   a. Raceway:
      1) The raceway base, cover, and divider shall be available in 8' lengths. The system shall be manufactured of rigid PVC compound and have a smooth texture and white color.
      2) The raceway shall be a two-piece design with a base and snap-on cover. Total width shall be 6.68" x 1.75" deep with an approximate thickness of .10". The raceway shall be provided with three wiring channels formed by integral barriers in the base. The base shall have one wiring channel with integral ribs in the bottom to accept divider sections. Divider walls, which snap on the base forming separate channels.
      3) The base shall have three wiring channels separated by two integral barriers. Channels must accommodate standard power and communication devices without restricting capacity of adjacent channels. Barriers shall be removable to form one or two channels and divider walls must be available to replace removed barriers.
      4) The cover shall have flanges to snap-on the base. The divider shall have integral slots that snap-on the base after the integral barrier has been removed.
      5) Fiber Optic / Category Cable Radius Full Capacity Corners and Fittings: A complete line of full capacity corner elbows must be available to maintain a controlled 2" cable bend radius which meets the specifications for Fiber Optic and Category cabling and exceeds the TIA / EIA 569 requirements for

communications pathways. Provide fittings as required. Fittings shall comply with this requirement regardless of type of wiring installed.

6) A full compliment of fittings shall be available including but not limited to flat, internal and external elbows, tees, entrance fittings, cover clips, and end caps. They shall overlap the cover and base to hide uneven cuts and color matched to raceway base and cover. All fittings shall include a base where applicable to eliminate mitering. A transition fitting shall be available to adapt to other raceways.

b. Device Brackets and Plates:

1) Device brackets shall be available for mounting standard devices in-line or offset from the raceway. A device bracket shall provide up to four single-gang openings at one location. Faceplates shall fit flush in the device plate.

c. Manufacturer:

1) Panduit T-70 series T70BIW10 Multichannel raceway, district standard, no substitutions.

2.03 WIREWAYS

A Manufacturers:

1. Cooper B-Line, a division of Cooper Industries: www.cooperindustries.com/#sle.
2. Hoffman, a brand of Pentair Technical Products: www.hoffmanonline.com/#sle.
3. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

B Description: Lay-in wireways and wiring troughs with removable covers; listed and labeled as complying with UL 870.

C Wireway Type, Unless Otherwise Indicated:

1. Indoor Clean, Dry Locations: NEMA EN 10250, Type 1, painted steel with screw-cover.
2. Outdoor Locations: NEMA EN 10250, Type 3R, painted steel with screw-cover; include provision for padlocking.

D Finish for Painted Steel Wireways: Manufacturer's standard grey unless otherwise indicated.

E Minimum Wireway Size: 4 by 4 inches unless otherwise indicated.

F Where wireway size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.04 SOURCE QUALITY CONTROL

A Factory test each production unit for pre-wired surface raceway systems to verify proper wiring.

PART 3 EXECUTION

3.01 EXAMINATION

A Verify that field measurements are as indicated.

B Verify that outlet boxes and conduit terminations are installed in proper locations and are properly sized in accordance with NFPA 70 to accommodate raceways.

C Verify that mounting surfaces are ready to receive raceways and that final surface finishes are complete, including painting.

D Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A Install products in accordance with manufacturer's instructions.

B Perform work in accordance with NECA 1 (general workmanship).

C Install raceways plumb and level.

D Arrange wireways and associated raceway connections to comply with NFPA 70, including but not limited to requirements for deflected conductors and wireways used as pullboxes. Increase size of wireway where necessary.

E Secure and support raceways in accordance with Section 26 05 29 at intervals complying with NFPA 70 and manufacturer's requirements.

F Close unused raceway openings.

G Provide grounding and bonding in accordance with Section 26 05 26.

H Identify raceways in accordance with Section 26 05 53.

I Prior to and during installation, refer to system layout drawing containing all elements of the system. Installer shall comply with the detailed manufacturer's instruction sheets, which accompany system components, or the complete system instruction sheets, whichever is applicable. Install per CEC 352.

J Raceway shall be cut to a smooth, even surface, without burrs or exposed sharp edges. System shall be mechanically continuous and connected to all electrical outlets, and conduits in accordance with manufacturers' instructions.

K Provide labels showing circuit and panels numbers at each device per owner's requirements.

3.03 FIELD QUALITY CONTROL

A Raceway shall be securely supported at intervals not exceeding 10 feet or in accordance with manufacturer's installation sheets.

B All raceway systems shall be installed complete, including insulating bushings and inserts where required by manufacturer's installation sheets. All unused raceway openings shall be closed.

C Provide clear ¼ inch wide label with black, typed 11 point lettering on all receptacle faceplates showing panelboard name and circuit number supplying receptacle, unless otherwise noted.

D Inspect raceways for damage and defects.

E Surface Raceway Systems with Integrated Devices: Test each wiring device to verify operation and proper polarity.

F Correct wiring deficiencies and replace damaged or defective raceways.

3.04 CLEANING

A Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 PROTECTION

A Protect installed raceways from subsequent construction operations.

END OF SECTION

SECTION 26 05 48
VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A Vibration isolation requirements.

B Seismic control requirements.

1. Includes requirements for seismic qualification of equipment not specified in this section.

C Vibration-isolated equipment support bases.

D Vibration isolators.

E Seismic restraint systems.

1.02 RELATED REQUIREMENTS

A Section 01 45 33 - Code-Required Special Inspections and Procedures.

B Section 03 30 00 - Cast-in-Place Concrete.

C Section 26 05 29 - Hangers and Supports for Electrical Systems.

1.03 DEFINITIONS

A Electrical Component: Where referenced in this section in regards to seismic controls, applies to any portion of the electrical system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., conduit, cable tray).

B Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

1.04 REFERENCE STANDARDS

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

B ASCE 19 - Structural Applications of Steel Cables for Buildings; 2016.

C ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.

D ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2022.

E FEMA 413 - Installing Seismic Restraints for Electrical Equipment; 2004.

F FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage; 2012.

G ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H ICC-ES AC156 - Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components; 2010, with Editorial Revision (2015).

I MFMA-4 - Metal Framing Standards Publication; 2004.

J NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

K NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2008.

1.05 ADMINISTRATIVE REQUIREMENTS

A Coordination:

1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
2. Coordinate the work with other trades to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Seismic Controls:
   a. Coordinate the arrangement of seismic restraints with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   b. Coordinate the work with other trades to accommodate relative positioning of essential and nonessential components in consideration of seismic interaction.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B Sequencing:
1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

1.06 SUBMITTALS

A Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.
2. Seismic Controls: Include seismic load capacities.

B Seismic Design Data:
1. Compile information on project-specific characteristics of actual installed electrical components necessary for determining seismic design forces required to design appropriate seismic controls, including but not limited to the following.
   a. Component operating weight and center of gravity.
   b. Component elevation in the building in relation to the roof elevation (z/h).
   c. Component importance factor (Ip).
   d. For distributed systems, component materials and connection methods.
   e. Component amplification factor (ap) and component response modification factor (Rp), determined in accordance with ASCE 7 tables.
   f. Applicability of overstrength factor (for certain anchorage in concrete and masonry).
2. Include structural calculations, stamped or sealed by seismic controls designer, demonstrating suitability of seismic controls for seismic design forces.

C Certification for seismically qualified equipment; identify basis for certification.

D Evaluation Reports: For products specified as requiring evaluation and recognition by a qualified evaluation service, provide current evaluation reports.

1.07 QUALITY ASSURANCE

A Comply with NFPA 70.

B Comply with applicable building code.

C Seismic Controls Designer Qualifications: Registered professional engineer licensed in the State in which the Project is located and with minimum five years experience designing seismic restraints for nonstructural components.
1. Designer may be employed by the manufacturer of the seismic restraint products.

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

1.08 DELIVERY, STORAGE, AND HANDLING

A Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

A Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing electrical equipment and/or electrical connections to vibration-isolated equipment.

B Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:

C General Requirements:
1. Select vibration isolators to provide required static deflection.
2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
3. Select seismic type vibration isolators to comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
4. Select vibration isolators for outdoor equipment to comply with wind design requirements.
5. Select vibration-isolated equipment support bases and associated vibration isolators to provide minimum 2-inch operating clearance beneath base unless otherwise indicated.

D Equipment Isolation:
1. Transformers:
   a. Specified vibration isolators are in addition to any factory-installed internal core and coil assembly vibration isolators unless otherwise indicated.
   b. Floor-Mounted Transformers, Seismic Applications: Use seismic type restrained spring isolators.
   c. Suspended Transformers, Seismic Applications: Use seismic type spring isolator hangers.
   d. Wall-Mounted Transformers, Seismic Applications: Use seismic type resilient material isolator mounts.
   e. Minimum Static Deflection:
      1) Transformers Mounted on Grade-Level Slabs: 0.25 inch deflection unless otherwise indicated.
      2) Transformers Mounted at Above-Grade Levels: 0.5 inch deflection unless otherwise indicated.
2. Engine Generators:
   a. Specified vibration isolators are in addition to any factory-installed internal vibration isolators between generator set and integral base unless otherwise indicated; obtain generator set manufacturer approval of applied vibration isolation.

b. Seismic Applications: Use seismic type restrained spring isolators.
c. Provide vibration-isolated concrete inertia bases where equipment is not designed to be point loaded.
d. Minimum Static Deflection:
1) Generators Mounted on Grade-Level Slabs: 1 inch deflection unless otherwise indicated.
2) Generators Mounted at Above-Grade Levels: 2 inch deflection unless otherwise indicated.

E Conduit Isolation:
1. Use flexible conduit or cable for electrical connections to vibration-isolated equipment, including equipment installed under other sections or by others.
a. Minimum Length: 3 feet unless otherwise indicated.
2. Vibration Isolators:
a. Provide vibration isolators for conduit supports:
1) Located within 50 feet of connected vibration-isolated equipment where flexible connection to equipment is not possible.
2) For conduits over 2 inch trade size located below or within 50 feet of noise-sensitive areas indicated.
b. Minimum Static Deflection:
1) First Three Supports Closest to Isolated Equipment: Same as static deflection of equipment; maximum of 2 inch deflection required.
2) Remainder of Supports: 0.75 inch deflection unless otherwise indicated.
c. Suspended Conduits, Seismic Applications: Use seismic type spring isolator hangers.
d. Use modular seal where vibration-isolated conduits penetrate building elements (e.g. walls, floors) arranged to prevent vibration transmission to structure.

2.02 SEISMIC CONTROL REQUIREMENTS

A Component Importance Factor (Ip): Electrical components essential to life safety to be assigned a component importance factor (Ip) of 1.5 as indicated or as required. This includes but is not limited to:
1. Electrical components required to function for life safety purposes after an earthquake.
2. Electrical components that support or otherwise contain hazardous substances.

B Seismic Qualification of Equipment:
1. Provide special certification for electrical equipment furnished under other sections and assigned a component importance factor (Ip) of 1.5, certifying that equipment will remain operable following a design level earthquake.
2. Seismic qualification to be by shake table testing in accordance with recognized testing standard procedure, such as ICC-ES AC156, acceptable to authorities having jurisdiction.
3. Notify Architect and obtain direction where mounting restrictions required by conditions of seismic certification conflict with specified requirements.
4. Seismically qualified equipment to be furnished with factory-installed labels referencing certificate of compliance and associated mounting restrictions.

C Premanufactured Modular Electrical Equipment: Where not otherwise seismically qualified, premanufactured modules 6 feet high and taller furnished under other sections to be designed in accordance with seismic provisions for nonbuilding structures.

D Seismic Restraints:

1. Provide seismic restraints for electrical components except where exempt according to applicable codes and specified seismic design criteria, as approved by authorities having jurisdiction.
2. Seismic Restraint Exemptions:
   a. Exemptions for Seismic Design Category C:
      1) Electrical components where either of the following apply:
         (a) The component importance factor (Ip) is 1.0 and the component is positively attached to the structure.
         (b) The component weighs 20 pounds or less or, in the case of a distributed system, 5 pounds per foot or less.
   b. Exemptions for Seismic Design Category D, E, and F:
      1) Discrete electrical components that are positively attached to the structure where either of the following apply:
         (a) The component weighs 400 pounds or less, has a center of mass located 4 feet or less above the adjacent floor level, flexible connections are provided between the component and associated ductwork, piping, and conduit, and the component importance factor (Ip) is 1.0.
         (b) The component weighs 20 pounds or less or, in the case of a distributed system, 5 pounds per foot or less.
   c. Conduit, Cable Tray, and Raceway Exemptions, All Seismic Design Categories:
      1) Raceways with component importance factor (Ip) of 1.0 where flexible connections are provided between cable tray or raceway and associated components, where cable tray or raceway is positively attached to the structure, and where one of the following apply:
         (a) Trapeze supported conduits, cable trays, or raceways with trapeze assemblies using 3/8 inch diameter rod hangers not exceeding 12 inches in length from support point connection to the supporting structure, and the total weight supported by any single trapeze is 100 pounds or less.
         (b) Trapeze supported conduits, cable trays, or raceways with trapeze assemblies using 1/2 inch diameter rod hangers not exceeding 12 inches in length from support point connection to the supporting structure, and the total weight supported by any single trapeze is 200 pounds or less.
         (c) Trapeze supported conduits, cable trays, or raceways with trapeze assemblies using 1/2 inch diameter rod hangers not exceeding 24 inches in length from support point connection to the supporting structure, and the total weight supported by any single trapeze is 100 pounds or less.
         (d) Hanger supported conduits, cable trays, or raceways with individual rod hangers 3/8 inch or 1/2 inch in diameter not exceeding 12 inches in length

from support point connection to the supporting structure, and the total weight supported by any single rod is 50 pounds or less.

2) Conduits less than 2-1/2 inch trade size.

d. Lighting Exemptions, All Seismic Design Categories:

1) Suspended luminaires where attachments are designed to accommodate 1.4 times the operating weight acting in both the vertical and horizontal directions and connections to structure allow for 360 degree range of motion in the horizontal plane; arrange to prevent impact between luminaires and the structure or other nonstructural components.

2) Lay-in luminaires weighing less than 56 pounds secured to ceiling grid and provided with safety wires in accordance with ASTM E580/E580M.

3. Comply with applicable general recommendations of the following, where not in conflict with applicable codes, seismic design criteria, or other specified requirements:
   a. ASHRAE (HVACA).
   b. FEMA 413.
   c. FEMA E-74.
   d. SMACNA (SRM).
4. Seismic restraint capacities to be verified by a Nationally Recognized Testing Laboratory (NRTL) or certified by an independent third-party registered professional engineer acceptable to authorities having jurisdiction.
5. Seismic Type Vibration Isolators:
   a. Comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
6. Seismic Restraint Systems:
   a. Except where otherwise restricted, use of either cable or rigid restraints is permitted.
   b. Use only cable restraints to restrain vibration-isolated electrical components, including distributed systems.
   c. Use only one restraint system type for a given electrical component or distributed system (e.g., conduit, cable tray) run; mixing of cable and rigid restraints on a given component/run is not permitted.
   d. Size restraint elements, including anchorage, to resist seismic loads as necessary to restrain electrical component in all lateral directions; consider bracket geometry in anchor load calculations.
   e. Use rod stiffener clips to attach bracing to hanger rods as required to prevent rod buckling from vertical (upward) compressive load introduced by cable or rigid restraints loaded in tension, in excess of downward tensile load due to supported electrical component weight.
   f. Select hanger rods and associated anchorage as required to accommodate vertical (downward) tensile load introduced by rigid restraints loaded in compression, in addition to downward tensile load due to supported electrical component weight.
   g. Clevis hangers may only be used for attachment of transverse restraints; do not use for attachment of longitudinal restraints.

h. Where seismic restraints are attached to clevis hangers, provide clevis bolt reinforcement accessory to prevent clevis hanger deformation.

i. Do not introduce lateral loads on open bar joist chords or the weak axis of beams, or loads in any direction at other than panel points unless approved by project Structural Engineer of Record.

j. Manufacturer's certified seismic restraint design may be submitted as an alternative to project-specific design and documentation, subject to approval of authorities having jurisdiction.

E Seismic Attachments:

1. Attachments to be bolted, welded, or otherwise positively fastened without consideration of frictional resistance produced by the effects of gravity.
2. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) or qualified evaluation service acceptable to authorities having jurisdiction for compliance with applicable building code, and qualified for seismic applications; concrete anchors to be qualified for installation in both cracked and uncracked concrete.
3. Do not use power-actuated fasteners.
4. Do not use friction clips (devices that rely on mechanically applied friction to resist loads). Beam clamps may be used for supporting sustained loads where provided with restraining straps.
5. Comply with anchor minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
6. Concrete Housekeeping Pads:
   a. Increase size of pad as required to comply with anchor requirements.
   b. Provide pad reinforcement and doweling to ensure integrity of pad and connection and to provide adequate load path from pad to supporting structure.

F Seismic Interactions:

1. Include provisions to prevent seismic impact between electrical components and other structural or nonstructural components.
2. Include provisions such that failure of a component, either essential or nonessential, does not cause the failure of an essential component.

G Seismic Relative Displacement Provisions:

1. Use suitable fittings or flexible connections to accommodate:
   a. Relative displacements at connections between components, including distributed systems (e.g., conduit, cable tray); do not exceed load limits for equipment utility connections.
   b. Relative displacements between component supports attached to dissimilar parts of structure that may move differently during an earthquake.
   c. Design displacements at seismic separations.
   d. Anticipated drifts between floors.

2.03 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

A Manufacturers:

1. Vibration-Isolated Equipment Support Bases:

a. Mason Industries; BR Restrained Bridge Mounts: www.mason-ind.com/#sle.

B Vibration-Isolated Structural Steel Bases:

1. Description: Engineered structural steel frames with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.

C Vibration-Isolated Concrete Inertia Bases:

1. Description: Concrete-filled engineered steel forms with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.
2. Minimum Base Depth: 6 inches.
3. Minimum Base Mass (Including Concrete): 1.5 times weight of supported equipment.
4. Concrete Reinforcement: Welded or tied reinforcing bars running both ways in a single layer.
5. Concrete: Filled on site with minimum 3000 psi concrete in accordance with Section 03 30 00.

2.04 VIBRATION ISOLATORS

A Manufacturers:

1. Vibration Isolators:
   a. Mason Industries; BR Restrained Bridge Mounts: www.mason-ind.com/#sle.

B General Requirements:

1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
2. Spring Elements for Spring Isolators:
   a. Color code or otherwise identify springs to indicate load capacity.
   b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
   c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
   d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
   e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
   f. Selected to function without undue stress or overloading.
3. Seismic Snubbing Elements for Seismic Isolators:
   a. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
   b. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

C Vibration Isolators for Seismic Applications:

1. Resilient Material Isolator Mounts, Seismic:
   a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) isolator material; specifically designed and rated for seismic applications with integral snubbing in all directions.
2. Spring Isolator Hangers, Seismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection; specifically designed

and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.

b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.

2.05 SEISMIC RESTRAINT SYSTEMS

A Manufacturers:

1. Seismic Restraint Systems:
   a. AFCON, a brand of Anvil International: www.anvilintl.com/#sle.
   b. Eaton Corporation: www.eaton.com/#sle.
   c. Mason Industries: www.mason-ind.com/#sle.

B Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.

C Cable Restraints:

1. Comply with ASCE 19.
2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength.
3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19.
4. Use protective thimbles for cable loops where potential for cable damage exists.

D Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.

PART 3 EXECUTION

3.01 EXAMINATION

A Verify that field measurements are as shown on the drawings.

B Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.

C Verify that conditions are satisfactory for installation prior to starting work.

3.02 CODE-REQUIRED SPECIAL INSPECTIONS

A Arrange work to accommodate tests and/or inspections performed by Special Inspection Agency employed by Owner or Architect in accordance with Section 01 45 33 and statement of special inspections as required by applicable building code.

B Frequency of Special Inspections: Where special inspections are designated as continuous or periodic, arrange work accordingly.

1. Continuous Special Inspections: Special Inspection Agency to be present in the area where the work is being performed and observe the work at all times the work is in progress.
2. Periodic Special Inspections: Special Inspection Agency to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

C Prior to starting work, Contractor to submit written statement of responsibility to authorities having jurisdiction and to Owner acknowledging awareness of special requirements contained in the statement of special inspections.

D Special Inspection Agency services do not relieve Contractor from performing inspections and testing specified elsewhere.

3.03 INSTALLATION

A Install products in accordance with manufacturer's instructions.

B Install products in accordance with applicable requirements of NECA 1 (general workmanship).

C Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

D Secure fasteners according to manufacturer's recommended torque settings.

E Install flexible conduit and cable connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

F Vibration Isolation Systems:

1. Vibration-Isolated Equipment Support Bases:
   a. Provide specified minimum clearance beneath base.
2. Spring Isolators:
   a. Position equipment at operating height; provide temporary blocking as required.
   b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
   c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
3. Isolator Hangers:
   a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.
   b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.
4. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
5. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
6. Adjust isolators to be free of isolation short circuits during normal operation.
7. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

G Seismic Controls:

1. Provide specified snubbing element air gap; remove any factory-installed spacers, debris or other obstructions.
2. Use only specified components, anchorage, and hardware evaluated by seismic design. Comply with conditions of seismic certification where applicable.
3. Where mounting hole diameter exceeds bolt diameter by more than 0.125 inch, use epoxy grout, elastomeric grommet, or welded washer to reduce clearance to 0.125 inch or less.
4. Equipment with Sheet Metal Housings:
   a. Use Belleville washers to distribute stress over a larger surface area of the sheet metal connection interface as approved by manufacturer.
   b. Attach additional steel as approved by manufacturer where required to transfer loads to structure.
   c. Where mounting surface is irregular, do not shim housing; reinforce housing with additional steel as approved by manufacturer.

5. Concrete Housekeeping Pads:
   a. Size in accordance with seismic design to meet anchor requirements.
   b. Install pad reinforcement and doweling in accordance with seismic design to ensure integrity of pad and associated connection to slab.
6. Seismic Restraint Systems:
   a. Do not attach seismic restraints and gravity supports to dissimilar parts of structure that may move differently during an earthquake.
   b. Install restraints within permissible angles in accordance with seismic design.
   c. Install cable restraints straight between component/run and structural attachment; do not bend around other nonstructural components or structural elements.
   d. Install cable restraints for vibration-isolated components slightly slack to prevent short-circuiting of isolation.
   e. Install hanger rod stiffeners where indicated using only specified clamps; do not weld stiffeners to hanger rod.

3.04 FIELD QUALITY CONTROL

A See Section 01 40 00 - Quality Requirements, for additional requirements.

B Inspect vibration isolation and/or seismic control components for damage and defects.

C Vibration Isolation Systems:
   1. Verify isolator static deflections.
   2. Verify required clearance beneath vibration-isolated equipment support bases.
   3. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.

D Seismic Controls:
   1. Verify snubbing element air gaps.

E Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

END OF SECTION

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A Electrical identification requirements.
B Identification nameplates and labels.
C Wire and cable markers.
D Voltage markers.
E Underground warning tape.
F Floor marking tape.
G Warning signs and labels.

1.02 RELATED REQUIREMENTS

A Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
B Section 26 05 36 - Cable Trays for Electrical Systems: Additional identification requirements for cable tray systems.
C Section 26 05 73 - Power System Studies: Arc flash hazard warning labels.
D Section 26 27 26 - Wiring Devices - Lutron: Device and wallplate finishes; factory pre-marked wallplates.
E Section 26 31 00 - Photovoltaic Collectors: Additional identification requirements for photovoltaic systems.
F Section 27 10 00 - Structured Cabling: Identification for communications cabling and devices.

1.03 REFERENCE STANDARDS

A ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2011 (Reaffirmed 2017).
B ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011 (Reaffirmed 2017).
C NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
D UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A Coordination:
1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B Sequencing:
1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
2. Do not install identification products until final surface finishes and painting are complete.

1.05 SUBMITTALS

A Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

1.06 QUALITY ASSURANCE

A Comply with requirements of NFPA 70.

1.07 FIELD CONDITIONS

A Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A Identification for Equipment:

1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
   a. Switchboards:
      1) Identify ampere rating.
      2) Identify voltage and phase.
      3) Identify power source and circuit number. Include location when not within sight of equipment.
      4) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
   b. Panelboards:
      1) Identify ampere rating.
      2) Identify voltage and phase.
      3) Identify power source and circuit number. Include location when not within sight of equipment.
      4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
      5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
      6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
   c. Transformers:
      1) Identify kVA rating.
      2) Identify voltage and phase for primary and secondary.
      3) Identify power source and circuit number. Include power source location when not within sight of equipment.
      4) Identify load(s) served. Include load location when not within sight of equipment.
   d. Enclosed switches, circuit breakers, and motor controllers:
      1) Identify voltage and phase.
      2) Identify power source and circuit number. Include power source location when not within sight of equipment.
      3) Identify load(s) served. Include load location when not within sight of equipment.
   e. Time Switches:
      1) Identify load(s) served and associated circuits controlled. Include location.
   f. Centralized Emergency Lighting Inverters:
      1) Identify input and output voltage and phase.

2) Identify power source and circuit number for normal power source. Include location when not within sight of equipment.
3) Identify load(s) served. Include location.

g. Transfer Switches:
1) Identify voltage and phase.
2) Identify power source and circuit number for both normal power source and standby power source. Include location when not within sight of equipment.
3) Identify load(s) served. Include location when not within sight of equipment.
4) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.
5) Identify type of loads served (e.g. Required Emergency, Required Standby, Optional Standby)

h. Electricity Meters:
1) Identify load(s) metered.
2) Unique meter identifier, use identification label.

2. Service Equipment:
a. Use identification nameplate to identify each service disconnecting means.
b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate or means of identification acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.

3. Emergency System Equipment:
a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
c. Use identification nameplate to identify emergency operating instructions for emergency system equipment.

4. Use identification nameplate to identify switchboards and panelboards utilizing a high leg delta system in accordance with NFPA 70.
5. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
6. Use identification label on inside of door at each fused switch to identify required NEMA fuse class and size.
7. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
8. Use field-painted floor markings or floor marking tape to identify required equipment working clearances.
9. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
a. Service equipment.

b. Industrial control panels.
c. Motor control centers.
d. Elevator control panels.

10. Arc Flash Hazard Warning Labels: Comply with Section 26 05 73.
11. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.
12. Use warning labels, identification nameplates, or identification labels to identify electrical hazards for equipment where multiple power sources are present with the word message "DANGER; Hazardous voltage; Multiple power sources may be present; Disconnect all electric power including remote disconnects before servicing" or approved equivalent.

B Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.
2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
3. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.

C Identification for Raceways:
1. Use voltage markers to identify highest voltage present for accessible conduits 2 inch (53 mm) trade size and larger at maximum intervals of 20 feet.
2. Use factory-painted conduits or field painted conduits to identify systems other than normal power system for accessible conduits. Refer to section 26 05 33.13 for color coding and additional requirements.
3. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.
4. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
5. Use underground warning tape to identify underground raceways.

D Identification for Cable Tray: Comply with Section 26 05 36.

E Identification for Boxes:
1. Use voltage markers to identify highest voltage present.
2. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
   a. For exposed boxes in public areas, use only identification labels.
3. Use warning labels to identify electrical hazards for boxes containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".

F Identification for Devices:
1. Identification for Communications Devices: Comply with Section 27 10 00.
2. Wiring Device and Wallplate Finishes: Comply with Section 26 27 26.

3. Use identification label to identify fire alarm system devices.
   a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
4. Use identification label to identify serving branch circuit for all receptacles.
5. Use identification label to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.

G Identification for Luminaires:
1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.

H Identification for Photovoltaic Systems: Comply with Section 26 31 00

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A Identification Nameplates:
1. Manufacturers:
   a. Brimar Industries, Inc: www.brimar.com/#sle.
   b. Seton Identification Products: www.seton.com/#sle.
2. Materials:
   a. Indoor Clean, Dry Locations: Use plastic nameplates.
   b. Outdoor Locations: Use plastic or aluminum nameplates suitable for exterior use.
3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
   a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.
4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B Identification Labels:
1. Manufacturers:
   a. Brady Corporation: www.bradyid.com/#sle.
   b. Brother International Corporation: www.brother-usa.com/#sle.
   c. Panduit Corp: www.panduit.com/#sle.
2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
   a. Use only for indoor locations.
3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C Format for Equipment Identification:
1. Minimum Size: 1 inch by 2.5 inches.
2. Legend:
   a. System designation where applicable:
      1) Emergency Power System: Identify with text "EMERGENCY".
      2) Standby Power System: Identify with text "STANDBY"

3) Fire Alarm System: Identify with text "FIRE ALARM".

b. Equipment designation or other approved description.

3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height:
   a. System Designation: 1 inch.
   b. Equipment Designation: 1/2 inch.
5. Color:
   a. Normal Power System: White text on black background.
   b. Emergency Power System: White text on red background.

D Format for General Information and Operating Instructions:

1. Minimum Size: 1 inch by 2.5 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/4 inch.
5. Color: Black text on white background unless otherwise indicated.

E Format for Caution and Warning Messages:

1. Minimum Size: 2 inches by 4 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/2 inch.
5. Color: Black text on yellow background unless otherwise indicated.

F Format for Receptacle Identification:

1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Power source and circuit number or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

G Format for Control Device Identification:

1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Load controlled or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

H Format for Fire Alarm Device Identification:

1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Designation indicated and device zone or address.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Red text on white background.

2.03 WIRE AND CABLE MARKERS

A Manufacturers:

1. Brady Corporation: www.bradyid.com/#sle.
2. HellermannTyton: www.hellermanntyton.com/#sle.
3. Panduit Corp: www.panduit.com/#sle.

B Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

C Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

D Legend: Power source and circuit number or other designation indicated.

E Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

F Minimum Text Height: 1/8 inch.

G Color: Black text on white background unless otherwise indicated.

2.04 VOLTAGE MARKERS

A Manufacturers:

1. Brady Corporation: www.bradyid.com/#sle.
2. Brimar Industries, Inc: www.brimar.com/#sle.
3. Seton Identification Products: www.seton.com/#sle.

B Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

C Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

D Minimum Size:

1. Markers for Equipment: 1 1/8 by 4 1/2 inches.
2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
3. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
4. Markers for Junction Boxes: 1/2 by 2 1/4 inches.

E Legend:

1. Markers for Voltage Identification: Highest voltage present.
2. Markers for System Identification:
   a. Emergency Power System: Text "EMERGENCY".

F Color: Black text on orange background unless otherwise indicated.

2.05 UNDERGROUND WARNING TAPE

A Manufacturers:

1. Brady Corporation: www.bradyid.com/#sle.
2. Brimar Industries, Inc: www.brimar.com/#sle.
3. Seton Identification Products: www.seton.com/#sle.

B Materials: Use foil-backed detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

C Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.

D Legend: Type of service, continuously repeated over full length of tape.

E Color:

1. Tape for Buried Power Lines: Black text on red background.

2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.06 FLOOR MARKING TAPE

A Manufacturers:
1. Brady Corporation: www.bradyid.com/#sle.
2. Brimar Industries, Inc: www.brimar.com/#sle.
3. Seton Identification Products: www.seton.com/#sle.

B Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlaminate, 3 inches wide, with alternating black and white stripes.

2.07 WARNING SIGNS AND LABELS

A Manufacturers:
1. Brimar Industries, Inc: www.brimar.com/#sle.
2. Clarion Safety Systems, LLC: www.clarionsafety.com/#sle.
3. Seton Identification Products: www.seton.com/#sle.

B Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

C Warning Signs:
1. Materials:
   a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
   b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
3. Minimum Size: 7 by 10 inches unless otherwise indicated.

D Warning Labels:
1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

A Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

A Install products in accordance with manufacturer's instructions.

B Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
1. Surface-Mounted Equipment: Enclosure front.
2. Flush-Mounted Equipment: Inside of equipment door.
3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
4. Elevated Equipment: Legible from the floor or working platform.
5. Branch Devices: Adjacent to device.
6. Interior Components: Legible from the point of access.

7. Conduits: Legible from the floor.
8. Boxes: Outside face of cover.
9. Conductors and Cables: Legible from the point of access.
10. Devices: Outside face of cover.

C Install identification products centered, level, and parallel with lines of item being identified.

D Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.

G Secure rigid signs using stainless steel screws.

H Mark all handwritten text, where permitted, to be neat and legible.

3.03 FIELD QUALITY CONTROL

A Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

SECTION 26 05 83
WIRING CONNECTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A Electrical connections to equipment.

1.02 RELATED REQUIREMENTS

A Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

B Section 26 05 33.13 - Conduit for Electrical Systems.

C Section 26 05 33.16 - Boxes for Electrical Systems.

D Section 26 27 26 - Wiring Devices.

E Section 26 28 16.16 - Enclosed Switches.

1.03 REFERENCE STANDARDS

A NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

B NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

C NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A Coordination:

1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
2. Determine connection locations and requirements.

B Sequencing:

1. Install rough-in of electrical connections before installation of equipment is required.
2. Make electrical connections before required start-up of equipment.

1.05 SUBMITTALS

A Product Data: Provide wiring device manufacturer’s catalog information showing dimensions, configurations, and construction.

1.06 QUALITY ASSURANCE

A Comply with requirements of NFPA 70.

B Products: Listed, classified, and labeled as suitable for the purpose intended.

C Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 MATERIALS

A Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.

1. Colors: Comply with NEMA WD 1.
2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

B Disconnect Switches: As specified in Section 26 28 16.16 and in individual equipment sections.

C Wiring Devices: As specified in Section 26 27 26.

D Flexible Conduit: As specified in Section 26 05 33.13.

E Wire and Cable: As specified in Section 26 05 19.

PART 3 EXECUTION

3.01 EXAMINATION

A Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

A Make electrical connections in accordance with equipment manufacturer's instructions.

B Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D Provide receptacle outlet to accommodate connection with attachment plug.

E Provide cord and cap where field-supplied attachment plug is required.

F Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H Install terminal block jumpers to complete equipment wiring requirements.

I Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION

SECTION 26 09 43
DIGITAL LIGHTING CONTROLS

DISTRIBUTED DIGITAL LIGHTING CONTROLS

1.01 GENERAL

A SECTION INCLUDES

1. Distributed Digital Lighting Control System, including:
   a. Digital Lighting and Plug Load Controls
   b. Dimming Controls
   c. On/Off Controls
   d. Relay Panels
   e. Emergency Lighting Control

1.02 RELATED WORK:

A See the following specification Section for work related to the work in this section:

1. Integrated Automation Control of HVAC- Integrated Automation, Building integrator shall provide integration of the lighting control system with Building Automation Systems
2. Lighting
3. LED Interior Lighting
4. Lighting Poles and Standards
5. LED Exterior Lighting
6. Emergency Lighting
7. Raceways for Communications Systems

1.03 STANDARDS AND CODES:

A Work and materials shall be in compliance and according to the requirements of the latest revision of the following Standards and Codes:

1. CEC - California Electrical Code
2. NFPA 70 - National Electrical Code; National Fire Protection Association.
3. NEMA - National Electrical Manufacturers Association
4. FCC emission standards
5. UL - Underwriters Laboratories, Inc. Listings
6. UL 2043 - Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products Installed in Air-Handling Spaces.
7. UL 20 - General Use Switches, Plug Load Controls
8. UL 924 - Standard for Emergency Lighting and Power Equipment

1.04 DESIGN AND PERFORMANCE REQUIREMENTS:

A Digital Lighting Management System shall accommodate the square-footage coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, switches, daylighting sensors and accessories that suit the required lighting and electrical system parameters.

B System shall conform to requirements of CEC [NFPA 70].

C System shall comply with FCC emission standards specified in part 15, sub-part J for commercial and residential application.

D System shall be listed under UL sections 916 and/or 508.

1.05 SUBMITTALS:

A As specified in Division 1 and Section 26 05 00.

B Product Data: Manufacturer's data sheets on each product to be used, including:

1. Catalog sheets and specifications.
2. Ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
3. Storage and handling requirements and recommendations.
4. Installation instructions.

C Shop Drawings: Wiring diagrams a for the various components of the System specified including:

1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.
2. Show location of all devices, including at minimum sensors, load controllers, and switches/dimmers for each area on reflected ceiling plans.
3. Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies.
4. Network riser diagram including floor and building level details. Include network cable specification. Illustrate points of connection to integrated systems. Coordinate integration with mechanical and/or other trades.

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

E Closeout Submittals:

1. Project Record Documents: Record actual installed locations and settings for lighting control devices.
2. Operation and Maintenance Manual:
   a. Include approved Shop Drawings and Product Data.
   b. Include Sequence of Operation, identifying operation for each room or space.
   c. Include manufacturer's maintenance information.
   d. Operation and Maintenance Data: Include detailed information on device programming and setup.
   e. Include startup and test reports.

1.06 QUALITY ASSURANCE:

A Manufacturer Qualifications: Company specializing in manufacturing of centralized and distributed lighting control systems with a minimum of 10 years documented experience.

B Installer Qualifications: Company certified by the manufacturer and specializing in installation of networked lighting control products with minimum three years documented experience.

C System Components: Demonstrate that individual components have undergone quality control and testing prior to shipping.

1.07 WARRANTY:

A Manufacturer shall provide a 5 year limited warranty on products within this installation, except where otherwise noted, and consisting of a one for one device replacement.

1.08 EXTRA MATERIALS:

A Deliver extra sets of items for Owner's use in maintenance as follows:

1. Occupancy Sensors: (1) of each type installed
2. Switches: (1) of each type installed

3. Room Controllers: (1) of each type installed
4. Emergency Lighting Control Units: (1) of each type installed

PART 2 PRODUCTS

2.01 MANUFACTURERS:

A Manufacturer: Wattstopper or approved equal.

2.02 DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM:

A Equipment Required: Lighting Control and Automation system as defined under this section covers the following equipment.

1. Digital Lighting Management (DLM) local network: Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.
2. Digital Room Controllers: Self-configuring, digitally addressable one, two or three relay plenum-rated controllers for on/off control. Selected models include 0-10 volt or line voltage forward phase control dimming outputs and integral current monitoring capabilities.
3. Digital Plug Load Controllers: Self-configuring, digitally addressable, single relay, plenum-rated application-specific controllers. Selected models include integral current monitoring capabilities.
4. Digital Occupancy Sensors: Self-configuring, digitally addressable, calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.
5. Digital Switches: Self-configuring, digitally addressable pushbutton on/off, dimming, and scene switches with two-way active infrared (IR) communications.
6. Digital Daylighting Sensors: Single-zone closed loop, multi-zone open loop and single-zone dual-loop daylighting sensors with two-way active infrared (IR) communications for daylight harvesting using switching, bi-level, tri-level or dimming control.
7. Configuration Tools: Handheld remote for room configuration and relay panel programming provides two way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away.
8. Digital Lighting Management (DLM) segment network: Linear topology, BACnet MS/TP network (1.5 twisted pair, shielded) to connect multiple DLM local networks for centralized control.
9. Network Bridge: Provides BACnet MS/TP-compliant digital networked communication between rooms, panels and the Segment Manager or building automation system (BAS) and automatically creates BACnet objects representative of connected devices.
10. Segment Manager: BACnet MS/TP-based controller with web browser-based user interface for system control, scheduling, power monitoring, room device parameter administration and reporting.
11. Programming and Configuration Software: Optional PC-native application capable of accessing DLM control parameters within a room, for the local network, via a USB adapter, or globally, for many segment networks simultaneously, via BACnet/IP communication.
12. Digital Lighting Management Relay Panel and Zone Controller: Provides up to 8, 24, or 48 mechanically latching relays. Relays include a manual override and a single push-on connector for easy installation or removal from the panel. Panel accepts program changes from handheld configuration tool for date and time, location, holidays, event scheduling, button binding and group programming. Provides BACnet MS/TP-compliant digital

networked communication between other lighting controls and/or building automation system (BAS). Zero relay Zone Controller primarily supports Digital Fixture Controller applications.

13. Emergency Lighting Control Unit (ELCU): Allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building

2.03 LOCAL NETWORK LMRJ-SERIES: DLM LOCAL NETWORK IS A FREE TOPOLOGY LIGHTING CONTROL PHYSICAL CONNECTION AND COMMUNICATION PROTOCOL DESIGNED TO CONTROL A SMALL AREA OF A BUILDING.

A Features of the DLM local network include:

1. Plug n' Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
2. Simple replacement of any device in the local DLM network with a standard off the shelf unit without requiring significant commissioning, configuration or setup.
3. Push n' Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.
4. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.

B Digital room devices connect to the local network using pre-terminated Cat 5e cables with RJ-45 connectors, which provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide serial communication data from individual end devices are not acceptable.

C If manufacturer's pre-terminated Cat5e cables are not used for the installation each cable must be individually tested and observed by authorized service representative following installation.

2.04 DIGITAL LOAD CONTROLLERS (ROOM, PLUG LOAD, AND FIXTURE CONTROLLERS)

A Digital Load Controllers: Digital controllers for lighting zones, fixtures and/or plug loads automatically bind room loads to the connected control devices in the space without commissioning or the use of any tools. Provide controllers to match the room lighting and plug load control requirements. Controllers are simple to install, and do not have dip switches/potentiometers, or require special configuration for standard Plug n' Go applications. Control units include the following features

1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
2. Simple replacement using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf device.
3. Multiple room controllers connected together in a local network must automatically arbitrate with each other, without requiring any configuration or setup, so that individual load numbers are assigned starting with load 1 to a maximum of 64, assigned based on each controller's device ID's from highest to lowest.
4. Device Status LEDs to indicate:
   a. Data transmission

b. Device has power
c. Status for each load
d. Configuration status

5. Quick installation features including:
   a. Standard junction box mounting
   b. Quick low voltage connections using standard RJ-45 patch cable
6. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:
   a. Turn on to 100 percent
   b. Turn off
   c. Turn on to last level
7. Each load be configurable to operate in the following sequences based on occupancy:
   a. Auto-on/Auto-off (Follow on and off)
   b. Manual-on/Auto-off (Follow off only)
8. Polarity of each load output shall be reversible, via digital configuration, so that on is off and off is on.
9. BACnet object information shall be available for the following objects:
   a. Load status
   b. Schedule state, normal or after-hours
   c. Demand Response enable and disable
   d. Room occupancy status
   e. Total room lighting and plug loads watts
   f. Electrical current
   g. Total watts per controller
   h. Total room watts/sq ft.
   i. Force on/off all loads
10. UL 2043 plenum rated
11. Manual override and LED indication for each load
12. Zero cross circuitry for each load
13. All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.
14. Dimming Room Controllers shall share the following features:
15. Each load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events.
16. Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.
17. The following dimming attributes may be changed or selected using a wireless configuration tool:
    a. Establish preset level for each load from 0-100 percent
    b. Set high and low trim for each load
    c. Initiate lamp burn in for each load of either 0, 12 or 100 hours

18. Override button for each load provides the following functions:
    a. Press and release for on/off control
    b. Press and hold for dimming control
19. Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver. LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.
20. Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100 percent dimming range defined by the minimum and maximum calibration trim.
21. Calibration and trim levels must be set per output channel. Devices that set calibration or trim levels per controller (as opposed to per load) are not acceptable.
22. All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable.

B Plug Load Controllers shall include:

1. 120 VAC, 60 Hz rated for 20A total load. Controller carries application-specific UL 20 rating for receptacle control.
2. One relay configuration with additional connection for unswitched load
3. Configurable additive time delay to extend plug load time delay beyond occupancy sensor time delay (e.g. a 10 minute additive delay in a space with a 20 minute occupancy sensor delay ensures that plug loads turn off 30 minutes after the space is vacated).
4. Factory default operation is Auto-on/Auto-off, based on occupancy
5. Real time current monitoring of both switched and un-switched load (LMPL-201 only)
6. Switching power supply
    a. Simple 150mA - Only 4 100 series devices on a Cat 5e local network (LMPL-101)
    b. Smart 250mA (LMPL-201)
7. RJ-45 DLM local network ports
    a. Three RJ-45 ports (LMPL-101)
    b. Four RJ-45 ports (LMPL-201)
8. WattStopper product numbers:
    a. Plug Load Controllers: LMPL-101, LMPL-201.
    b. Wireless Transceiver and Receptacles: WRC-TX-LM, WRC-15-1/2, WRC-20-1/2

2.05 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR SYSTEM

A Wall or ceiling mounted (to suit installation) passive infrared, ultrasonic or dual technology digital (passive infrared and ultrasonic) occupancy sensor. Furnish the Company's system which accommodates the square footage coverage requirements for each area controlled, utilizing Room Controller modules and accessories which suits the lighting and electrical system parameters.

B Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:

1. Digital calibration and LCD entry for the following variables:
    a. Sensitivity 0-100% in 10% increments
    b. Time Delay – Fixed (1-30 minutes in 1 minute increments), and automatic
    c. Test mode – Five second time delay

d. PIR, Ultrasonic or Dual Technology activation and/or re-activation.
e. Walk-through mode
f. Load parameters including auto/manual ON, blink warning, and daylight enable/disable.

2. One or two RJ-45 digital connections for DLM local network.
3. Two-way infrared communications port to allow remote programming through hand held commissioning tool.
4. Device Status LED's including:
   a. PIR Detection
   b. Ultrasonic detection
   c. Configuration mode
   d. Load binding
5. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
6. Manual override of controlled loads.

C Units will provide for digital calibration and commissioning and will not have any dip switches or potentiometers for field settings

D Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required

E Manufacturer: The Watt Stopper LMPX, LMDX, LMPC, LMUC, LMDC or approved equal.

2.06 SINGLE / DUAL RELAY WALL SWITCH VACANCY SENSORS

A Passive infrared sensing technology- Type PW: Manual ON, Automatic OFF Wall switch type passive infrared occupancy sensor with built-in override control (off-auto). Furnish the Company's model which suits the electrical system parameters, and accommodates the square footage coverage and wattage requirement for each area (and type of lighting) controlled; Watt Stopper PW-100, PW-200 PW-103, PW-203 or approved equal.

B Ultrasonic sensing technology- Type UW: Manual ON, Automatic OFF Wall switch type ultrasonic occupancy sensor with built-in override control (off-auto). Furnish the Company's model which suits the electrical system parameters, and accommodates the square footage coverage and wattage requirement for each area (and type of lighting) controlled; Watt Stopper UW-100, UW-200 or approved equal.

C Dual-tech (utilizing both passive infrared and ultrasonic) sensing technology- Type DW: Manual ON, Automatic OFF Wall switch type dual technology, passive Infrared and ultrasonic occupancy sensor with built-in override control (off-auto). Furnish the Company's model which suits the electrical system parameters, and accommodates the square footage coverage and wattage requirement for each area (and type of lighting) controlled; Watt Stopper DW-100, DW-200, DW-103, DW-203 or approved equal.

2.07 DIGITAL WALL SWITCHES:

A Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration. Wall switches shall include the following features:

1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.

3. Configuration LED on each switch that blinks to indicate data transmission.
4. Load/Scene Status LED on each switch button with the following characteristics:
   a. Bi-level LED
   b. Dim locator level indicates power to switch
   c. Bright status level indicates that load or scene is active
   d. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.
5. Programmable control functionality including:
   a. Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority
   b. Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.
6. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.

B BACnet object information shall be available for the following objects:
1. Button state
2. Switch lock control
3. Switch lock status

C Two RJ-45 ports for connection to DLM local network.

D Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required to achieve multi-way switching.

E Load and Scene button function may be reconfigured for individual buttons from Load to Scene, and vice versa.
1. Individual button function may be configured to Toggle, On only or Off only.
2. Individual scenes may be locked to prevent unauthorized change.
3. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
4. Ramp rate may be adjusted for each dimmer switch.
5. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.
6. WattStopper product numbers: LMSW-101, LMSW-102, LMSW-103, LMSW-104, LMSW-105, LMSW-108, LMDM-101. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.

2.08 DIGITAL DAYLIGHT SENSORS:

A Digital daylighting sensors shall work with load controllers and relay panels to provide automatic switching, bi-level, or tri-level or dimming daylight harvesting capabilities for any load type connected to the controller or panel. Daylighting sensors shall be interchangeable without the need for rewiring.
1. Closed loop sensors measure the ambient light in the space and control a single lighting zone.

2. Open loop sensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones.
3. Dual loop sensors measure both ambient and incoming daylight in the space to insure that proper light levels are maintained as changes to reflective materials are made in a single zone

B Digital daylighting sensors shall include the following features:

1. Sensor's internal photodiode shall only measure lightwaves within the visible spectrum. The photodiode's spectral response curve shall closely match the entire photopic curve. Photodiode shall not measure energy in either the ultraviolet or infrared spectrums. Photocell shall have a sensitivity of less than 5 percent for any wavelengths less than 400 nanometers or greater than 700 nanometers.
2. Sensor light level range shall be from 1-6,553 foot-candles (fc).
3. Capability of ON/OFF, bi-level or tri-level switching, or dimming, for each controlled zone, depending on the selection of load controller(s) and load binding to controller(s).
4. For switching daylight harvesting, the photosensor shall provide a field-selectable deadband, or a separation, between the "ON Setpoint" and the "OFF Setpoint" that will prevent the lights from cycling excessively after they turn off.
5. For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a field-selectable minimum level.
6. Photosensors shall have a digital, independently configurable fade rate for both increasing and decreasing light level in units of percent per second.
7. Photosensors shall provide adjustable cut-off time. Cut-off time is defined by the number of selected minutes the load is at the minimum output before the load turns off. Selectable range between 0-240 minutes including option to never cut-off.
8. Integral infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.
9. Configuration LED status light on device that blinks to indicate data transmission.
10. Status LED indicates test mode, override mode and load binding.
11. Recessed switch on device to turn controlled load(s) ON and OFF.
12. BACnet object information shall be available for the following daylighting sensor objects, based on the specific photocell's settings:
    a. Light level
    b. Day and night setpoints
    c. Off time delay
    d. On and off setpoints
    e. Up to three zone setpoints
    f. Operating mode - on/off, bi-level, tri-level or dimming
13. One RJ-45 port for connection to DLM local network.
14. A choice of accessories to accommodate multiple mounting methods and building materials. Photosensors may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox. Standard tube photosensors accommodate mounting materials from 0-

0.62 inch thick (LMLS-400, LMLS-500). Extended tube photosensors accommodate mounting materials from 0.62 to 1.25 inches thick (LMLS-400-L, LMLS-500-L). Mounting brackets are compatible with J boxes (LMLS-MB1) and wall mounting (LMLS-MB2). LMLS-600 photosensor to be mounted on included bracket below skylight well.

15. Any load or group of loads in the room can be assigned to a daylighting zone
16. Each load within a daylighting zone can be individually enabled or disabled for discrete control (load independence).
17. All digital parameter data programmed into a photosensor shall be retained in non-volatile FLASH memory within the photosensor itself. Memory shall have an expected life of no less than 10 years.

2.09 HANDHELD CONFIGURATION TOOLS:

A Provide a wireless configuration tool to facilitate customization of DLM local networks using two-way infrared communications, and/or PC software that connects to each local network via a USB interface.

B Features and functionality of the wireless configuration tool shall include but not be limited to:

1. Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.
2. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.
3. Must be able to read and modify parameters for load controllers and relay panels, occupancy sensors, wall switches, daylighting sensors, network bridges, and identify DLM devices by type and serial number.
4. Save up to eight occupancy sensor setting profiles, and apply profiles to selected sensors.
5. Temporarily adjust light level of any load(s) on the local network, and incorporate those levels in scene setting. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
6. Adjust or fine-tune daylighting settings established during auto-configuration, and input light level data to complete configuration of open loop daylighting controls.
7. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
8. Verify status of building level network devices.

C WattStopper Product Numbers: Handheld LMCT-100

2.10 DLM SEGMENT NETWORK

A Provide a segment network using linear topology, BACnet-based MS/TP subnet to connect DLM local networks (rooms) and LMCP relay panels for centralized control.

1. Each connected DLM local network shall include a single network bridge (LMBC-300), and the network bridge is the only room-based device that is connected to the segment network.
2. Network bridges, relay panels and segment managers shall include terminal blocks, with provisions for separate "in" and "out" terminations, for segment network connections.
3. Segment network utilizes 1.5 twisted pair, shielded, cable supplied by the lighting control manufacturer. Maximum cable run for each segment is 4,000 feet. Conductor-to-conductor capacitance of the twisted pair shall be less than 30 pf/ft and have a characteristic impedance of 120 Ohms.

4. Network wire jacket is available in high visibility green, white, or black.
5. Substitution of manufacturer-supplied cable is not permitted and may void the warranty, if non-approved cable is installed, and if terminations are not completed according to manufacturer's specific requirements.
6. Network signal integrity requires that each conductor and ground wire be correctly terminated at every connected device.
7. Segment networks shall be capable of connecting to any of the following: BACnet-compliant BAS (provided by others) directly via MS/TP, or BACnet/IP via an NB-ROUTER or LMSM Unit. Systems whose room-connected network infrastructure require gateway devices to provide BACnet data to a BAS are unacceptable

B WattStopper Product Number: LM-MSTP, LM-MSTP-W, LM-MSTP-B, LM-MSTP-DB

2.11 NETWORK BRIDGE:

A Network bridge module connects a DLM local network to a BACnet-compliant segment network for communication between rooms, relay panels and a segment manager or BAS. Each local network shall include a network bridge component to provide a connection to the local network room devices. Network bridge shall use industry standard BACnet MS/TP network communication and an optically isolated EIA/TIA RS-485 transceiver.

1. Network bridge shall be provided as a separate module connected on the local network through an available RJ-45 port.
2. Provide Plug n' Go operation to automatically discover room devices connected to the local network and make all device parameters visible to the segment manager via the segment network. No commissioning shall be required for set up of the network bridge on the local network.
3. Network bridge shall automatically create standard BACnet objects for selected DLM devices to allow any BACnet-compliant BAS to include lighting control and power monitoring features as provided by the DLM devices on each local network. BACnet objects will be created for the addition or replacement of any given DLM device for the installed life of the system. Products requiring that an application-specific point database be loaded to create or map BACnet objects are not acceptable. Systems not capable of providing BACnet data for control devices via a dedicated BACnet Device ID and physical MS/TP termination per room are not acceptable. Standard BACnet objects shall be provided as follows:
   a. Read/write the normal or after hours schedule state for the room
   b. Read the detection state of each occupancy sensor
   c. Read the aggregate occupancy state of the room
   d. Read/write the On/Off state of loads
   e. Read/write the dimmed light level of loads
   f. Read the button states of switches
   g. Read total current in amps, and total power in watts through the load controller
   h. Read/write occupancy sensor time delay, PIR sensitivity and ultrasonic sensitivity settings
   i. Activate a preset scene for the room
   j. Read/write daylight sensor fade time and day and night setpoints

k. Read the current light level, in foot-candles, from interior and exterior photosensors and photocells
l. Set daylight sensor operating mode
m. Read/write wall switch lock status
n. Read watts per square foot for the entire controlled room
o. Write maximum light level per load for demand response mode
p. Read/write activation of demand response mode for the room
q. Activate/restore demand response mode for the room

4. WattStopper product numbers: LMBC-300

2.12 LMCP LIGHTING CONTROL PANELS AND LMZC ZONE CONTROLLER:

A Hardware: Provide LMCP lighting control panels in the locations and capacities as indicated on the Drawing and schedules. Each panel shall be of modular construction and consist of the following components:

1. Enclosure/Tub shall be NEMA 1, sized to accept an interior with 1 - 8 relays, 1 - 24 relays and 6 four-pole contactors, or 1 - 48 relays and 6 four-pole contactors.
2. Cover shall be configured for surface or flush wall mounting of the panel as indicated on the plans. LMCP panel cover shall have a hinged and lockable door with restricted access to line voltage section of the panel.
3. Interior assembly shall be supplied as a factory assembled component specifically designed and listed for field installation. Interior construction shall provide total isolation of high voltage (Class 1) wiring from low voltage (Class 2) wiring within the assembled panel. Interior assembly shall include intelligence boards, power supply, DIN rails for mounting optional Class 2 control devices, and individually replaceable latching type relays. Panel interiors shall include the following features:
   a. Removable, plug-in terminal blocks with connections for all low voltage terminations.
   b. Individual terminal block, override pushbutton, and LED status light for each relay.
   c. Direct wired switch inputs associated with each relay shall support 2-wire momentary switches only.
   d. Digital inputs (four RJ-45 jacks) shall support 1-, 2-, 3-, 4-, and 8-button digital switches; digital IO modules capable of receiving 0-5V or 0-10V analog photocell inputs; digital IO modules capable of receiving momentary or maintained contact closure inputs or analog sensor inputs; digital daylighting sensors; and digital occupancy sensors. Inputs are divided into two separate digital networks, each capable of supplying 250mA to connected devices.
   e. True relay state shall be indicated by the on-board LED and shall be available to external control devices and systems via BACnet.
   f. Automatically sequenced operation of relays to reduce impact on the electrical distribution system when large loads are controlled simultaneously.
   g. Group and pattern control of relays shall be provided through a simple keypad interface from a handheld IR programmer. Any set of relays can be associated with a group for direct on/off control or pattern (scene) control via a simple programming sequence using the relay override pushbuttons and LED displays for groups 1-8 or a handheld IR programmer for groups 1-99.

h. Relay group status for shall be provided through LED indicators for groups 1-8 and via BACnet for groups 1-99. A solid LED indicates that the last group action called for an ON state and relays in the group are on or in a mixed state.

4. Single-pole latching relays with modular plug-in design. Relays shall provide the following ratings and features:
   a. Electrical:
   b. 30 amp ballast at 277V
   c. 20 amp ballast at 347V
   d. 20amp tungsten at 120V
   e. 30 amp resistive at 347V
   f. HP motor at 120V
   g. 14,000 amp short circuit current rating (SCCR) at 347V
   h. Relays shall be specifically UL 20 listed for control of plug-loads
   i. Mechanical:
   j. Replaceable, 1/2 inch KO mounting with removable Class 2 wire harness.
   k. Actuator on relay housing provides manual override and visual status indication, accessible from Class 2 section of panel.
   l. Dual line and load terminals each support two #14 - #12 solid or stranded conductors.
   m. Tested to 300,000 mechanical on/off cycles.
5. Isolated low voltage contacts provide for true relay status feedback and pilot light indication.
6. Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells as necessary to meet the project requirements. Power supply to have internal over-current protection with automatic reset and metal oxide varistor protection.
7. Where indicated, lighting control panels designated for control of emergency lighting shall be provided with factory installed provision for automatic by pass of relays controlling emergency circuits upon loss of normal power. Panels shall be properly listed and labeled for use on emergency lighting circuits and shall meet the requirements of UL924 and NFPA 70 - Article 700.
8. Integral system clock shall provide scheduling capabilities for panel-only projects without DLM segment networks or BAS control.
   a. Each panel shall include digital clock capability able to issue system wide automation commands to up to 11 other panels for a total of 12 tnetworked lighting control panels. Clock shall provide capability for up to 254 independent schedule events per panel for each of the ninety-nine system wide channel groups.
   b. Clock capability of each panel shall support the time-based energy saving requirements of applicable local energy codes.
   c. Clock module shall provide astronomic capabilities, time delays, blink warning, daylight savings, and holiday functions and will include a battery back up for clock function and program retention in non-volatile FLASH memory. Clocks that require multiple events to meet local code lighting shut off requirements shall not be allowed.

d. Clock capability of each panel shall operate on a basis of ON/OFF or Normal Hours/After Hours messages to automation groups that implement pre-configured control scenarios. Scenarios shall include:
e. Scheduled ON / OFF
f. Manual ON / Scheduled OFF
g. Astro ON / OFF (or Photo ON / OFF)
h. Astro and Schedule ON / OFF (or Photo and Schedule ON / OFF)
i. User interface shall be a portable IR handheld remote control capable of programming any panel in the system (LMCT-100)
j. Clock capability of each panel shall employ non-volatile memory and shall retain user programming and time for a minimum of 10 years.
k. Schedules programmed into the clock of any one panel shall be capable of executing panel local schedule or Dark/Light (photocell or Astro) events for that panel in the event that global network communication is lost. Lighting control panels that are not capable of executing events independently of the global network shall not be acceptable.

9. Lighting control panel can operate as a stand-alone system, or can support schedule, group, and photocell control functions, as configured in a Segment Manager controller, via a segment network connection.
10. Lighting control panel shall support digital communications to facilitate the extension of control to include interoperation with building automation systems and other intelligent field devices. Digital communications shall be RS485 MS/TP-based using the BACnet protocol.
    a. Panel shall have provision for an individual BACnet device ID and shall support the full 222 range (0 - 4,193,304). The device ID description property shall be writable via the network to allow unique identification of the lighting control panel on the network.
    b. Panel shall support MS/TP MAC addresses in the range of 0 - 127 and baud rates of 9600k, 38400k, 76800k, and 115.2k bits per second.
    c. Lighting control relays shall be controllable as binary output objects in the instance range of 1 - 64. The state of each relay shall be readable and writable by the BAS via the object present value property.
    d. Lighting control relays shall report their true on/off state as binary input objects in the instance range of 1 - 64.
    e. The 99 group Normal Hours/After Hours control objects associated with the panel shall be represented by binary value objects in the instance range of 201 - 299. The occupancy state of each channel group shall be readable and writable by the BAS via the object present value property. Commanding 1 to a channel group will put all relays associated with the channel into the normal hours mode. Commanding 0 or NULL shall put the relays into the after hours mode.
    f. Setup and commissioning of panel shall not require manufacturer-specific software or a computer. All configuration of the lighting control panel shall be performed using standard BACnet objects or via the handheld IR programming remote. Provide BACnet objects for panel setup and control as follows:

g. Binary output objects in the instance range of 1 - 64 (one per relay) for on/off control of relays.
h. Binary value objects in the instance range of 1 - 99 (one per channel) for normal hours/after hours schedule control.
i. Binary input objects in the instance range of 1 - 64 (one per relay) for reading true on/off state of the relays.
j. Analog value objects in the instance range of 101 - 199 (one per channel group) shall assign a blink warn time value to each channel. A value of 5 shall activate the blink warn feature for the channel and set a 5-minute grace-time period. A value of 250 shall activate the sweep feature for the channel and enable the use of sweep type automatic wall switches.
k. Description property for all objects shall be writable via the network and shall be saved in non-volatile memory within the panel.
l. BO and BV 1 - 99 objects shall support BACnet priority array with a relinquish default of off and after hours respectively. Prioritized writes to the channel BV objects shall propagate prioritized control to each member relay in a way analogous to the BACnet Channel object described in addendum aa. (http://www.bacnet.org/Addenda/Add-135-2010aa.pdf)
m. Panel-aggregate control of relay Force Off at priority 2 shall be available via a single BV5 object. Force On at priority 1 shall be available via a single BV4 object.
n. Lockout of all digital switch buttons connected to a given panel shall be command-able via a single BV2 object. The lock status of any connected switch station shall be represented as BV101-196.

11. In addition to the LMCP Relay Panels, an LMZC Zone Controller panel shall be available for zero-relay applications. The panel is designed for applications where LMFC-011 Fixture Controllers or other distributed load controllers are used to switch and/or dim the controlled loads. Key similarities to and differences from the LMCP panel design shall include:
    a. Use the same intelligence board as the LMCP relay panel.
    b. Shall not include relay driver boards or relays.
    c. Have a removable interior section to facilitate installation, and a Tub/Cover. Cover is for surface mounting applications only.
    d. Tub shall have two interior KOs to allow installation of LMPB-100 Power Boosters. Each installed Power Booster can provide an additional 150 mA for either of the two available DLM local networks provided by the LMZC.
    e. All programming and networking (whether DLM Local Network and/or Segment Network) capabilities in the LMZC Zone Controller shall be similar to capabilities for LMCP relay panels, except for functions designed for panel-mounted HDR relays.
12. To aid in project start up, if LMFC Fixture Controllers are connected to an LMZC Zone Controller, Plug n' Go automatic configuration will establish a unique sequence of operation so that all LMFC-controlled fixtures will turn on to 50 percent output when any digital occupancy sensor detects motion.
13. WattStopper Product Number: Relay Panels: LMCP8, LMCP24 or LMCP48, Zone Controller: LMZC-301.

B User Interface: Each lighting control panel system shall be supplied with at least one handheld configuration tool (LMCT-100). As a remote programming interface the configuration tool shall allow setup, configuration, and diagnostics of the panel without the need for software or connection of a computer. User interface shall have the following panel-specific functions as a minimum:

1. Set network parameters including panel device ID, MS/TP MAC address, baud rate and max master range.
2. Relay Group creation of up to 99 groups. Group creation shall result in programming of all seven key relay parameters for member relays. The seven parameters are as follows: After-hours Override Time Delay, Normal Hours Override Time Delay, Action on Transition to Normal Hours, Action on Transition to After Hours, Sensor Action During Normal Hours, Sensor Action During After Hours, Blink-Warn Time for After Hours.
3. Program up to 254 separate scheduled events. Events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays. Holidays are also defined through the User Interface.
4. Program up to 32 separate Dark/Light events. Events shall have a selectable source as either calculated Astro with delay, or a digital IO module with an integral 0-5V or 0-10V analog photocell. Dark/Light events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays.
5. Button binding of digital switches to groups shall be accessible via the handheld IR remote and accomplished from the digital switch station.
6. Programming of panel location information shall be accomplished by the handheld IR remote and include at a minimum LAT, LON, DST zone, and an approximate city/state location.
7. WattStopper Product Number: LMCT-100

2.13 SEGMENT MANAGER:

A For networked applications, the Digital Lighting Management system shall include at least one segment manager to manage network communication. It shall be capable of serving up a graphical user interface via a standard web browser utilizing either unencrypted TCP/IP traffic via a configurable port (default is 80) or 256 bit AES encrypted SSL TCP/IP traffic via a configurable port (default is 443).

B Each segment manager shall have integral support for at least three segment networks. Segment networks may alternately be connected to the segment manger via external BACnet-to-IP interface routers and switches, using standard Ethernet structured wiring. Each router shall accommodate one segment network. Provide the quantity of routers and switches as shown on the Drawings.

C Operational features of the Segment Manager shall include the following:

1. Connection to PC or LAN via standard Ethernet TCP/IP via standard Ethernet TCP/IP with the option to use SSL encrypted connections for all traffic.
2. Easy to learn and use graphical user interface, compatible with Internet Explorer 8, or equal browser. The Segment Manager shall not require installation of any lighting control software on an end-user PC.
3. Log in security capable of restricting some users to view-only or other limited operations.

4. Segment Manager shall provide two main sets of interface screens - those used to initially configure the unit (referred to as the config screens), and a those used to allow users to dynamic monitor the performance of their system, and provide a centralized scheduling interface. Capabilities using the Config Screens shall include:
    a. Automatic discovery of DLM devices and relay panels on the segment network(s). Commissioning beyond activation of the discovery function shall not be required to provide communication, monitoring or control of all local networks and lighting control panels.
    b. Allow information for all discovered DLM devices to be imported into the Segment Manager via a single XML based site file from the WattStopper LMCS Software, significantly reducing the time needed to make a system usable by the end user. Importable information can include text descriptions of every DLM component and individual loads, and automatic creation of room location information and overall structure of DLM network. Info entered into LMCS should not have to be re-entered manually via keystrokes into the Segment Manager
    c. After discovery, all rooms and panels shall be presented in a standard navigation tree format. Selecting a device from the tree will allow the device settings and operational parameters to be viewed and changed by the user.
    d. Ability to view and modify DLM device operational parameters. It shall be possible to set device parameters independently for normal hours and after hours operation including sensor time delays and sensitivities, and load response to sensor including Manual-On or Auto-On.
    e. Provide capabilities for integration with a BAS via BACnet protocol. At a minimum, the following points shall be available to the BAS via BACnet IP connection to the segment manager: room occupancy state; room schedule mode; room switch lock control; individual occupancy sensor state; room lighting power; room plug-load power; load ON/OFF state; load dimming level; panel channel schedule state; panel relay state; and Segment Manager Group schedule state control. Any of above items shall be capable of being moved into an "Export Table" that will provide any integrator with only the data they need, and by using the Export Table effectively create a firewall between the integrator's request for info and the overall system performance.
5. Capabilities using the Segment Manager's Dashboard Screens shall include:
    a. A dynamic "tile" based interface that allows easy viewing of each individual room's lighting and plug load power consumption, and lighting and plug load power density (power consumption information requires Enhanced DLM Room and Plug Load Controllers with integral current transducers such as LMRC-21x).Tiles will be automatically organized according to location so a single tile for the building summarizes all information for tiles beneath it on every floor, in every area, in every room. Tiles use three color coded energy target parameters, allowing an owner to quickly identify rooms that are not performing efficiently. Tiles for rooms with occupancy sensors shall include an icon to indicate whether that room is occupied. Tiles shall be clickable, and when clicked the underlying hierarchical level of tiles shall become visible. Tile interface shall be accessible via mouse, or touch screen devices.

Tiles shall be created automatically by the segment manager, based on the information found during the device discovery and/or information included in a file imported in from LMCS (such as tagged descriptions for each room) without any custom programming.

b. Ability to set up schedules for DLM local networks (rooms) and panels. Schedules shall be capable of controlling individual rooms with either on/off or normal hours/after hours set controlled zones or areas to either a normal hours or after hours mode of operation. Support for annual schedules, holiday schedules and unique date-bound schedules, as well as astro On or astro Off events with offsets. Schedules shall be viable graphically as time bars in a screen set up to automatically show scheduled events by day, week or month.

c. Ability to provide a simple time vs. power graph based on information stored in each Segment Manager's memory (typically two to three days' data).

6. If shown on the Drawings, Segment Managers shall be integrated into a larger control network by the addition of a Network Supervisor package. The Supervisor is a server level computer running a version of the Segment Manager interface software with dedicated communication and networking capability, able to pull information automatically from each individual Segment Manager in the network. By using a Supervisor, information for individual Segment Managers can be accessed and stored on the Supervisor's hard drive, eliminating the risk of data being overwritten after a few days because of Segment Manager memory limits.

7. Segment Manager shall allow access and control of the overall system database via Native Niagara AX FOX connectivity. Systems that must utilize a Tridium Niagara controller in addition to the programming, scheduling and configuration server are not acceptable.

D Segment Manager shall support multiple DLM rooms as follows:

1. Support up to 120 network bridges and 900 digital in-room devices (LMSM-3E).
2. Support up to 300 network bridges and 2,200 digital in room devices, connected via network routers and switches (LMSM-6E).

E WattStopper Product Numbers: LMSM-3E, LMSM-6E, LM-SUPERVISOR, NB-ROUTER, NB-SWITCH, NB-SWITCH-8, NB-SWITCH-16.

2.14 PROGRAMMING, CONFIGURATION, AND DOCUMENTATION SOFTWARE:

A PC-native application for optional programming of detailed technician-level parameter information for all DLM products, including all parameters not accessible via BACnet and the handled IR configuration tool. Software must be capable of accessing room-level parameter information locally within the room when connected via the optional LMCI-100 USB programming adapter, or globally for many segment networks simultaneously utilizing standard BACnet/IP communication.

1. Additional parameters exposed through this method include but are not limited to:
   a. Occupancy sensor detection LED disable for performance and other aesthetic spaces where blinking LEDs present a distraction.
   b. Six occupancy sensor action behaviors for each controlled load, separately configurable for normal hours and after hours modes. Modes include: No Action, Follow Off Only, Follow On Only, Follow On and Off, Follow On Only with Override

Time Delay, Follow Off Only with Blink Warn Grace Time, Follow On and Off with Blink Warn Grace Time.

c. Separate fade time adjustments per load for both normal and after hours from 0 - 4 hours.

d. Configurable occupancy sensor re-trigger grace period from 0 - 4 minutes separate for both normal hours and after hours.

e. Separate normal hours and after hours per-load button mode with modes including: Do nothing, on only, off only, on and off.

f. Load control polarity reversal so that on events turn loads off and vice versa.

g. Per-load DR (demand response) shed level in units of percent.

h. Load output pulse mode in increments of 1second.

i. Fade trip point for each load for normal hours and after hours that establishes the dimmer command level at which a switched load closes its relay to allow for staggered On of switched loads in response to a dimmer.

2. Generation of reports at the whole file, partial file, or room level. Reports include but are not limited to:

a. Device list report: All devices in a project listed by type.

b. Load binding report: All load controller bindings showing interaction with sensors, switches, and daylighting.

c. BACnet points report: Per room Device ID report of the valid BACnet points for a given site's BOM.

d. Room summary report: Device manifest for each room, aggregated by common BOM, showing basic sequence of operations.

e. Device parameter report: Per-room lists of all configured parameters accessible via hand held IR programmer for use with O&M documentation.

f. Scene report: All project scene pattern values not left at defaults (i.e. 1 = all loads 100 percent, 2 = all loads 75 percent, 3 = all loads 50 percent, 4 = all loads 25 percent, 5-16 = same as scene 1).

g. Occupancy sensor report: Basic settings including time delay and sensitivities for all occupancy sensors.

3. Network-wide programming of parameter data in a spreadsheet-like programming environment including but not limited to the following operations:

a. Set, copy/paste an entire project site of sensor time delays.

b. Set, copy/paste an entire project site of sensor sensitivity settings.

c. Search based on room name and text labels.

d. Filter by product type (i.e. LMRC-212) to allow parameter set by product.

e. Filter by parameter value to search for product with specific configurations.

4. Network-wide firmware upgrading remotely via the BACnet/IP network.

a. Mass firmware update of entire rooms.

b. Mass firmware update of specifically selected rooms or areas.

c. Mass firmware upgrade of specific products

B WattStopper Product Number: LMCS-100, LMCI-100

2.15 EMERGENCY LIGHTING CONTROL DEVICES:

A Emergency Lighting Control Unit - A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:

1. 120/277 volts, 50/60 Hz, 20 amp ballast rating
2. Push to test button
3. Auxiliary contact for remote test or fire alarm system interface

B WattStopper Product Numbers: ELCU-100, ELCU-200.

PART 3 EXECUTION

3.01 PRE-INSTALLATION MEETINGS:

A Convene minimum two weeks prior to commencing Work of this section. Meeting to be attended by Contractor, Architect, system installer, factory authorized manufacturer's representative, and representative of all trades related to the system installation.

B Review installation procedures and coordination required with related Work and the following:

1. Confirm the location and mounting of all devices, with special attention to placement of switches, dimmers, and any sensors.
2. Review the specifications for low voltage control wiring and termination.
3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.
4. Discuss requirements for integration with other trades

C Inspect and make notes of job conditions prior to installation:

1. Record minutes of the conference and provide copies to all parties present.
2. Identify all outstanding issues in writing designating the responsible party for follow-up action and the timetable for completion.
3. Installation shall not begin until all outstanding issues are resolved to the satisfaction of the Architect.

3.02 DELIVERY, STORAGE, AND HANDLING:

A Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation

3.03 PROJECT CONDITIONS:

A Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B Do not install equipment until following conditions can be maintained in spaces to receive equipment:

1. Ambient temperature: 32 to 104 degrees F (0 to 40 degrees C).
2. Relative humidity: Maximum 90 percent, non-condensing.

3.04 PREPARATION:

A Do not begin installation until measurements have been verified and work areas have been properly prepared.

B If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C Verify that required pre-installation meeting has been completed, recorded meeting minutes have been distributed and all outstanding issues noted have been resolved prior to the start of installation.

3.05 INSTALLATION:

A Install system in accordance with the approved system shop drawings and manufacturer's instructions.

B Install all room/area devices using manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors.

1. If pre-terminated cable is not used for room/area wiring, each field-terminated cable shall be tested following installation and testing results submitted to the Manufacturer's Representative for approval prior to proceeding with the Work.
2. Install all room to room network devices using manufacturer-supplied LM-MSTP network wire. Network wire substitution is not permitted and may result in loss of product warranty.
3. Low voltage wiring topology must comply with manufacturer's specifications.
4. Route network wiring as indicated on the Drawings as closely as possible. Document final wiring location, routing and topology on as built drawings.

C All line voltage connections shall be tagged to indicate circuit and switched legs.

D Test all devices to ensure proper communication.

E Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings. Adjust time delay so that controlled area remains lighted while occupied.

F Provide written or computer-generated documentation on the configuration of the system including room by room description including:

1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
3. Load Parameters (e.g. blink warning, etc.)

G Post start-up tuning - Adjust sensor time delays and sensitivities to meet the Owner's requirements 30 days from beneficial occupancy. Provide a detailed report to the Architect / Owner of post start-up activity.

H Tighten all panel Class I conductors from both circuit breaker and to loads to torque ratings as marked on enclosure UL label.

I All Class II cabling shall enter enclosures from within low-voltage wiring areas and shall remain within those areas. No Class I conductors shall enter a low-voltage area.

J Run separate neutrals for any phase dimmed branch load circuit. Different types of dimming loads shall have separate neutral.

K Verify all non-panel-based lighting loads to be free from short circuits prior to connection to room controllers.

3.06 FIELD QUALITY CONTROL:

A Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Notify Architect and Manufacturer in writing a minimum of 3 weeks prior to system start-up and testing.

B Tests and Inspections: Manufacturer's service representative shall perform the following inspections and prepare reports.

1. Verify Class I and II wiring connections are terminated properly by validating system performance.
2. Set IP addresses and other network settings of system front end hardware per facilities IT instructions.
3. Verify / complete task programming for all switches, dimmers, time clocks, and sensors.
4. Verify that the control of each space complies with the Sequence of Operation.
5. Correct any system issues and retest..

C Provide a report in table format with drawings, or using a software file that can be opened in the manufacturer's system software including each room or space that has lighting control installed. Indicate the following:

1. Date of test or inspection.
2. Loads per space, or Fixture Address identification.
3. Quantity and Type of each device installed
4. Reports providing each device's settings.

3.07 DEMONSTRATION AND TRAINING:

A Before Substantial Completion, arrange and provide a one-day Owner instruction period to designated Owner personnel. Set-up, starting of the lighting control system and Owner instruction includes:

1. Confirmation of entire system operation and communication to each device.
2. Confirmation of operation of individual relays, switches, and sensors.
3. Confirmation of system Programming, photocell settings, override settings, etc.
4. Provide training to cover installation, programming, operation, and troubleshooting of the lighting control system.

3.08 PRODUCT SUPPORT AND SERVICE:

A Factory telephone support shall be available at no cost to the Owner following acceptance. Factory assistance shall consist of assistance in solving application issues pertaining to the control equipment.

END OF SECTION

SECTION 26 24 16
PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A Power distribution panelboards.

B Lighting and appliance panelboards.

C Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

A Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.

B Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C Section 26 05 29 - Hangers and Supports for Electrical Systems.

D Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.

E Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

F Section 26 05 73 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

G Section 26 22 00 - Low-Voltage Transformers: Small power centers with integral primary breaker, transformer, and panelboard.

H Section 26 27 13 - Electricity Metering: For interface with equipment specified in this section.

I Section 26 43 00 - Surge Protective Devices.

1.03 REFERENCE STANDARDS

A FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).

B NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C NECA 407 - Standard for Installing and Maintaining Panelboards; 2015.

D NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

E NEMA PB 1 - Panelboards; 2011.

F NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 1000V or Less; 2023.

G NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

H NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

J UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

K UL 67 - Panelboards; Current Edition, Including All Revisions.

L UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

M UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

N UL 1699 - Arc-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

B Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
2. Include wiring diagrams showing all factory and field connections.
3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
4. Include documentation of listed series ratings upon request.
5. Identify mounting conditions required for equipment seismic qualification.

C Manufacturer's equipment seismic qualification certification.

D Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as routine tests.

E Field Quality Control Test Reports.

F Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

H Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

I Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Panelboard Keys: Two of each different key.

1.06 QUALITY ASSURANCE

A Comply with requirements of NFPA 70.

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

C Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

B Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A Maintain ambient temperature within the following limits during and after installation of panelboards:

1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A ABB/GE; _____: www.electrification.us.abb.com/#sle.

B Eaton Corporation; _____: www.eaton.com/#sle.

C Schneider Electric; Square D Products; _____: www.schneider-electric.us/#sle.

D Siemens Industry, Inc; _____: www.usa.siemens.com/#sle.

2.02 PANELBOARDS - GENERAL REQUIREMENTS

A Provide products listed, classified, and labeled as suitable for the purpose intended.

B Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:

1. Altitude: Less than 6,600 feet.
2. Ambient Temperature:
   a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

C Short Circuit Current Rating:

1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.

D Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

E Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

F Bussing: Sized in accordance with UL 67 temperature rise requirements.

1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

G Conductor Terminations: Suitable for use with the conductors to be installed.

H Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:

a. Indoor Clean, Dry Locations: Type 1.
b. Outdoor Locations: Type 3R.
c. Indoor or Outdoor where subject to directional water or severe corrosion (e.g. hose-down areas in kitchens or where subject to salt water): Type 4X
d. Class 1, Division 1 (Groups A, B, C, or D) Locations: Type 7 or 8.

2. Boxes: Galvanized steel unless otherwise indicated.
   a. Provide wiring gutters sized to accommodate the conductors to be installed.
   b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
   c. Provide painted steel boxes for surface-mounted panelboards where indicated, finish to match fronts.
3. Fronts:
   a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
   b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
   c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
4. Lockable Doors: All locks keyed alike unless otherwise indicated.

I Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

J Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 43 00, list and label panelboards as a complete assembly including surge protective device.

K Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

L Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.

M Provide the following features and accessories where indicated or where required to complete installation:
1. Feed-through lugs.
2. Sub-feed lugs.

2.03 POWER DISTRIBUTION PANELBOARDS

A Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B Conductor Terminations:
1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
2. Main and Neutral Lug Type: Mechanical.

C Bussing:
1. Phase and Neutral Bus Material: Copper.
2. Ground Bus Material: Copper.

D Circuit Breakers:
1. Provide bolt-on type.

2. Provide thermal magnetic circuit breakers unless otherwise indicated.

E Enclosures:

1. Provide surface-mounted enclosures unless otherwise indicated.
2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide clear plastic circuit directory holder mounted on inside of door.

2.04 LIGHTING AND APPLIANCE PANELBOARDS

A Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B Conductor Terminations:

1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
2. Main and Neutral Lug Type: Mechanical.

C Bussing:

1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
2. Phase and Neutral Bus Material: Copper.
3. Ground Bus Material: Copper.

D Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E Enclosures:

1. Provide surface-mounted or flush-mounted enclosures as indicated.
2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide clear plastic circuit directory holder mounted on inside of door.

2.05 OVERCURRENT PROTECTIVE DEVICES

A Molded Case Circuit Breakers:

1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
2. Interrupting Capacity:
   a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated.
   b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
3. Conductor Terminations:
   a. Provide mechanical lugs unless otherwise indicated.
   b. Lug Material: Copper, suitable for terminating copper conductors only.
4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
   a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.

b. Provide interchangeable trip units for circuit breaker frame sizes 600 amperes and larger.

5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
6. Provide the following circuit breaker types where indicated:
   a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
   b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
   c. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.
   d. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
   e. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
7. Do not use tandem circuit breakers.
8. Do not use handle ties in lieu of multi-pole circuit breakers.
9. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
10. Provide the following features and accessories where indicated or where required to complete installation:
    a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
    b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.
    c. Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
    d. Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
    e. Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

2.06 SOURCE QUALITY CONTROL

A Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION

3.01 EXAMINATION

A Verify that field measurements are as indicated.

B Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C Verify that mounting surfaces are ready to receive panelboards.

D Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A Perform work in accordance with NECA 1 (general workmanship).

B Install products in accordance with manufacturer's instructions.

C Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

D Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E Provide required support and attachment in accordance with Section 26 05 29.

F Install panelboards plumb.

G Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

H Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

I Mount floor-mounted power distribution panelboards on properly sized 6 inch high concrete pad constructed in accordance with Section 03 30 00.

J Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

K Provide grounding and bonding in accordance with Section 26 05 26.

L Install all field-installed branch devices, components, and accessories.

M Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

N Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.

O Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 26 05 73.

P Provide filler plates to cover unused spaces in panelboards.

Q Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:

1. Fire detection and alarm circuits.

R Identify panelboards in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

A See Section 01 40 00 - Quality Requirements, for additional requirements.

B Inspect and test in accordance with NETA ATS, except Section 4.

C Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 225 amperes. Tests listed as optional are not required.

D Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

E Test GFCI circuit breakers to verify proper operation.

F Test AFCI circuit breakers to verify proper operation.

G Test shunt trips to verify proper operation.

H Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

I Correct deficiencies and replace damaged or defective panelboards or associated components.

3.04 ADJUSTING

A Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B Adjust alignment of panelboard fronts.

C Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.05 CLEANING

A Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A Wall switches.

B Receptacles.

C Wall plates.

1.02 RELATED REQUIREMENTS

A Section 26 05 33.16 - Boxes for Electrical Systems.

B Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

C Section 26 05 83 - Wiring Connections: Cords and plugs for equipment.

1.03 REFERENCE STANDARDS

A FS W-C-596 - Connector, Electrical, Power, General Specification for; 2014h (Validated 2022).

B FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification); 2017g (Validated 2023).

C NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

D NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

E NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

F NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

G NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

I UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

J UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

K UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

L UL 1310 - Class 2 Power Units; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A Coordination:

1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings. Switches shall be located on the strike side of the door, unless otherwise noted, and shall not be obstructed by the door when it is in the open position.
4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B Sequencing:

1. Do not install wiring devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

A Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

B Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

C Operation and Maintenance Data:

1. GFCI Receptacles: Include information on status indicators.

D Project Record Documents: Record actual installed locations of wiring devices.

E Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Screwdrivers for Tamper-Resistant Screws: Two for each type of screw.
2. Extra Wall Plates: One of each style, size, and finish.

1.06 QUALITY ASSURANCE

A Comply with requirements of NFPA 70.

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

C Products: Listed, classified, and labeled as suitable for the purpose intended.

D Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND PROTECTION

A Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.01 WIRING DEVICE APPLICATIONS

A Provide wiring devices suitable for intended use and with ratings adequate for load served.

B For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.

D Provide tamper resistant receptacles for receptacles installed in dwelling units, kindergarten classrooms, and daycare facilities.

E Provide GFCI protection for receptacles installed within 6 feet of sinks.

F Provide GFCI protection for receptacles installed in kitchens.

G Provide GFCI protection for receptacles serving electric drinking fountains.

H Unless noted otherwise, do not use combination switch/receptacle devices.

2.02 WIRING DEVICE FINISHES

A Provide wiring device finishes as described below unless otherwise indicated.

B Wiring Devices Installed in Finished Spaces: White with white nylon wall plate.

C Wiring Devices Installed in Finished Spaces : White with stainless steel wall plate.

D Wiring Devices Installed in Unfinished Spaces: White with galvanized steel wall plate.

E Wiring Devices Installed in Wet or Damp Locations: White with specified weatherproof cover.

2.03 WALL SWITCHES

A Manufacturers:

1. Hubbell Incorporated: www.hubbell.com/#sle.
2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.

1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

C Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.04 RECEPTACLES

A Manufacturers:

1. Hubbell Incorporated: www.hubbell.com/#sle.
2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.

1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
2. NEMA configurations specified are according to NEMA WD 6.

C Convenience Receptacles:

1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
2. Automatically Controlled Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; controlled receptacle marking on device face per NFPA 70; single or duplex as indicated on the drawings.
3. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
4. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.

D GFCI Receptacles:

1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
   a. Provide test and reset buttons of same color as device.
2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.

3. Combination AFCI and GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as a combination GFCI/AFCI protective device and complying with UL 498, UL 943, and UL 1699A.
4. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.
5. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.

E USB Charging Devices:

1. USB Charging Devices - General Requirements: Listed as complying with UL 1310.
   a. Charging Capacity - Two-Port Devices: 2.1 A, minimum.
   b. Charging Capacity - Four-Port Devices: 4.2 A, minimum.
2. USB Charging/Tamper Resistant Receptacle Combination Devices: Two-port (One Type-A and One Type-C) USB charging device and receptacle, commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; rectangular decorator style.
3. USB Charging Noncombination Devices: Four-port (Two Type-A and Two Type-C); rectangular decorator style.

2.05 WALL PLATES

A Manufacturers:

1. Hubbell Incorporated: www.hubbell-wiring.com/#sle.
2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B Wall Plates: Comply with UL 514D.

1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
2. Size: Standard.
3. Screws: Metal with slotted heads finished to match wall plate finish.

C Nylon Wall Plates: Smooth finish, high-impact thermoplastic.

D Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

E Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.

F Premarked Wall Plates: Factory labeled as indicated; hot stamped for nylon wall plates and engraved for metal wall plates.

G Weatherproof Covers for Wet or Damp Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

PART 3 EXECUTION

3.01 EXAMINATION

A Verify that field measurements are as indicated.

B Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C Verify that wall openings are neatly cut and will be completely covered by wall plates.

D Verify that final surface finishes are complete, including painting.

E Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

F Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A Provide extension rings to bring outlet boxes flush with finished surface.

B Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of wiring devices provided under this section.

1. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
2. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
3. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
4. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

C Install wiring devices in accordance with manufacturer's instructions.

D Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

I Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.

J Install wiring devices plumb and level with mounting yoke held rigidly in place.

K Install wall switches with OFF position down.

L Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

M Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

N Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

O Identify wiring devices in accordance with Section 26 05 53.

3.04 FIELD QUALITY CONTROL

A Inspect each wiring device for damage and defects.

B Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.

C Test each receptacle to verify operation and proper polarity.

D Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

E Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

A Adjust devices and wall plates to be flush and level.

3.06 CLEANING

A Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 26 28 13
FUSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A Fuses.

B Spare fuse cabinet.

1.02 RELATED REQUIREMENTS

A Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

B Section 26 05 73 - Power System Studies: Additional criteria for the selection of protective devices specified in this section.

C Section 26 28 16.16 - Enclosed Switches: Fusible switches.

1.03 REFERENCE STANDARDS

A NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.

B NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.

D UL 248-4 - Low-Voltage Fuses - Part 4: Class CC Fuses; Current Edition, Including All Revisions.

E UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A Coordination:

1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.

1. Spare Fuse Cabinet: Include dimensions.

B Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Fuses: One set(s) of three for each type and size installed.
2. Fuse Pullers: One set(s) compatible with each type and size installed.
3. Spare Fuse Cabinet Keys: Two.

1.06 QUALITY ASSURANCE

A Comply with requirements of NFPA 70.

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

C Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A Bussmann, a division of Eaton Corporation: www.cooperindustries.com/#sle.

B Littelfuse, Inc: www.littelfuse.com/#sle.

C Mersen: ep-us.mersen.com/#sle.

2.02 APPLICATIONS

A General Purpose Branch Circuits: Class RK1, time-delay.

B Individual Motor Branch Circuits: Class RK1, time-delay.

C In-Line Protection for Pole-Mounted Luminaires: Class CC, time-delay.

D Primary Protection for Control Transformers: Class CC, time-delay.

2.03 FUSES

A Provide products listed, classified, and labeled as suitable for the purpose intended.

B Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C Provide fuses of the same type, rating, and manufacturer within the same switch.

D Comply with UL 248-1.

E Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.

F Voltage Rating: Suitable for circuit voltage.

G Class R Fuses: Comply with UL 248-12.

H Class CC Fuses: Comply with UL 248-4.

I Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

2.04 SPARE FUSE CABINET

A Description: Wall-mounted sheet metal cabinet with shelves and hinged door with cylinder lock, suitably sized to store spare fuses and fuse pullers specified.

B Finish: Manufacturer's standard, factory applied grey finish unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

B Verify that mounting surfaces are ready to receive spare fuse cabinet.

C Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A Do not install fuses until circuits are ready to be energized.

B Install fuses with label oriented such that manufacturer, type, and size are easily read.

C Install spare fuse cabinet where indicated.

D Identify spare fuse cabinet in accordance with Section 26 05 53.

END OF SECTION

SECTION 26 28 16.16
ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A Enclosed safety switches.

1.02 RELATED REQUIREMENTS

A Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B Section 26 05 29 - Hangers and Supports for Electrical Systems.

C Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.

D Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

E Section 26 05 73 - Power System Studies: Additional criteria for the selection of equipment and associated protective devices specified in this section.

F Section 26 28 13 - Fuses.

1.03 REFERENCE STANDARDS

A NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

C NEMA BS 31047 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013 (Reaffirmed 2023).

D NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

E NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A Coordination:

1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

B Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
1. Identify mounting conditions required for equipment seismic qualification.

C Manufacturer's equipment seismic qualification certification.

D Field Quality Control Test Reports.

E Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

F Project Record Documents: Record actual locations of enclosed switches.

G Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

H Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 26 28 13 for requirements for spare fuses and spare fuse cabinets.

1.06 QUALITY ASSURANCE

A Comply with requirements of NFPA 70.

B Maintain at the project site a copy of each referenced document that prescribes execution requirements.

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

D Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A Maintain ambient temperature between -22 degrees F and 104 degrees F during and after installation of enclosed switches.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A ABB/GE: www.electrification.us.abb.com/#sle.

B Eaton Corporation: www.eaton.com/#sle.

C Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

D Siemens Industry, Inc: www.usa.siemens.com/#sle.

E Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ENCLOSED SAFETY SWITCHES

A Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

B Provide products listed, classified, and labeled as suitable for the purpose intended.

C Seismic Qualification: Provide enclosed safety switches suitable for application under the seismic design criteria specified in Section 26 05 48 where required. Include certification of compliance with submittals.

D Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
1. Altitude: Less than 6,600 feet.
2. Ambient Temperature: Between -22 degrees F and 104 degrees F.

E Horsepower Rating: Suitable for connected load.

F Voltage Rating: Suitable for circuit voltage.

G Short Circuit Current Rating:
1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.
2. Minimum Ratings:
   a. Switches Protected by Class H Fuses: 10,000 rms symmetrical amperes.
   b. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.
   c. Double Throw Switches Protected by Class R, Class J, or Class T Fuses: 100,000 rms symmetrical amperes.

H Provide with switch blade contact position that is visible when the cover is open.

I Fuse Clips for Fusible Switches: As required to accept fuses indicated.
1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

J Conductor Terminations: Suitable for use with the conductors to be installed.

K Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

L Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

M Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.
1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor Clean, Dry Locations: Type 1.
   b. Outdoor Locations: Type 3R.

N Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

O Heavy Duty Switches:
1. Comply with NEMA BS 31047.
2. Conductor Terminations:
   a. Provide mechanical lugs unless otherwise indicated.
   b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.
    a. Provide means for locking handle in the ON position where required.

P Provide the following features and accessories where indicated or where required to complete installation:

1. Hubs: As required for environment type; sized to accept conduits to be installed.
2. Integral fuse pullers.
3. Auxiliary Switch: SPDT switch suitable for connection to system indicated, with auxiliary contact operation before switch blades open and after switch blades close.

PART 3 EXECUTION

3.01 EXAMINATION

A Verify that field measurements are as indicated.

B Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C Verify that mounting surfaces are ready to receive enclosed safety switches.

D Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A Install products in accordance with manufacturer's instructions.

B Perform work in accordance with NECA 1 (general workmanship).

C Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D Provide required support and attachment in accordance with Section 26 05 29.

E Provide required seismic controls in accordance with Section 26 05 48.

F Install enclosed switches plumb.

G Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

H Provide grounding and bonding in accordance with Section 26 05 26.

I Provide fuses complying with Section 26 28 13 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

J Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

K Identify enclosed switches in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

A Inspect and test in accordance with NETA ATS, except Section 4.

B Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

C Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.04 ADJUSTING

A Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 51 00
INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A Interior luminaires.
B Emergency lighting units.
C Exit signs.
D Ballasts and drivers.
E Accessories.

1.02 RELATED REQUIREMENTS

A Section 26 05 29 - Hangers and Supports for Electrical Systems.
B Section 26 05 33.16 - Boxes for Electrical Systems.
C Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
D Section 26 27 26 - Wiring Devices: Manual wall switches and wall dimmers.

1.03 REFERENCE STANDARDS

A IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 2013 (Corrigendum 2019).
B IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information; 2019.
C IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2019.
D IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.
E NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
F NECA/IESNA 500 - Standard for Installing Indoor Lighting Systems; 2006.
G NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.
H NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Disharge Ballasts; 2020.
I NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012 (Reaffirmed 2018).
J NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
K NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
L UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.
M UL 1598 - Luminaires; Current Edition, Including All Revisions.
N UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A Coordination:
1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.

2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A Shop Drawings:
1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
2. Provide photometric calculations where luminaires are proposed for substitution.

B Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
1. LED Luminaires:
a. Include estimated useful life, calculated based on IES LM-80 test data.
b. Include IES LM-79 test report upon request.

C Certificates for Dimming Ballasts: Manufacturer's documentation of compatibility with dimming controls to be installed.

D Field quality control reports.

E Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F Operation and Maintenance Data: Instructions for each product including information on replacement parts.

G Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. Extra Lenses and Louvers: Two percent of total quantity installed for each type, but not less than one of each type.

H Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.06 QUALITY ASSURANCE

A Comply with requirements of NFPA 70.

B Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND PROTECTION

A Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

B Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

A Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A Provide five year manufacturer warranty for LED luminaires, including drivers.

B Provide 5-year pro-rata warranty for batteries for emergency lighting units.

C Provide 10-year pro-rata warranty for batteries for self-powered exit signs.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A Furnish products as indicated in luminaire schedule included on the drawings.

2.02 LUMINAIRES

A Provide products that comply with requirements of NFPA 70.

B Provide products that are listed and labeled as complying with UL 1598, where applicable.

C Provide products listed, classified, and labeled as suitable for the purpose intended.

D Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G Recessed Luminaires:

1. Ceiling Compatibility: Comply with NEMA LE 4.
2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

H LED Luminaires:

1. Components: UL 8750 recognized or listed as applicable.
2. Tested in accordance with IES LM-79 and IES LM-80.
3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

I LED Tape Lighting Systems: Provide all power supplies, drivers, cables, connectors, channels, covers, mounting accessories, and interfaces as necessary to complete installation.

1. LED Tape - General Requirements:
   a. Listed.
   b. Designed for field cutting in accordance with listing.
   c. Wet Location Applications: IEC 60529, IP 68 (waterproof) rated.

J Track Lighting Systems: Provide track compatible with specified track heads, with all connectors, power feed fittings, dead ends, hangers and canopies as necessary to complete installation.

K Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

2.03 EXIT SIGNS

A Description: Exit signs complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.
1. Number of Faces: Single- or double-face as indicated or as required for installed location.
2. Directional Arrows: As indicated or as required for installed location.

B Powered Exit Signs: Internally illuminated with LEDs unless otherwise indicated.
1. Self-Powered Exit Signs:
a. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
b. Battery: Sealed, maintenance-free, nickel cadmium unless otherwise indicated.
c. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
d. Provide low-voltage disconnect to prevent battery damage from deep discharge.
e. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

2.04 BALLASTS AND DRIVERS

A Ballasts/Drivers - General Requirements:
1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
3. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.

B Dimmable LED Drivers:
1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
2. Control Compatibility: Fully compatible with the dimming controls to be installed.

2.05 ACCESSORIES

A Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.

B Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

C Provide accessory plaster frames for luminaires recessed in plaster ceilings.

D Fire-Rated Luminaire Enclosures:
1. Manufacturers:
a. Fire Rated Product Specialties Corp: www.frpsonline.com/#sle.
b. Specialty Products & Insulation (SPI); SafeLite: www.spi-co.com/#sle.
2. Provide as required to preserve fire resistance rating of building elements.

PART 3 EXECUTION

3.01 EXAMINATION

A Verify that field measurements are as indicated.

B Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C Verify that suitable support frames are installed where required.

D Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A Provide extension rings to bring outlet boxes flush with finished surface.

B Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of luminaires provided under this section.

B Perform work in accordance with NECA 1 (general workmanship).

C Install products in accordance with manufacturer's instructions.

D Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

E Provide required support and attachment in accordance with Section 26 05 29.

F Provide required seismic controls in accordance with Section 26 05 48.

G Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

H Suspended Ceiling Mounted Luminaires:

1. Do not use ceiling tiles to bear weight of luminaires.
2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
4. Secure pendant-mounted luminaires to building structure.
5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
6. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gauge, connected from opposing corners of each recessed luminaire to building structure.
7. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

I Recessed Luminaires:

1. Install trims tight to mounting surface with no visible light leakage.
2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

J Suspended Luminaires:

1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.

2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet between supports.
4. Install canopies tight to mounting surface.
5. Unless otherwise indicated, support pendants from swivel hangers.

K Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

L Install accessories furnished with each luminaire.

M Bond products and metal accessories to branch circuit equipment grounding conductor.

N Exit Signs:

1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

3.04 FIELD QUALITY CONTROL

A Inspect each product for damage and defects.

B Operate each luminaire after installation and connection to verify proper operation.

C Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.

D Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 ADJUSTING

A Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.

C Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.06 CLEANING

A Clean surfaces according to NECA 500 (commercial lighting) and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

3.08 PROTECTION

A Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 26 56 00
EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A Exterior luminaires.
B Ballasts.
C Poles and accessories.
D Luminaire accessories.

1.02 RELATED REQUIREMENTS

A Section 26 05 26 - Grounding and Bonding for Electrical Systems.
B Section 26 05 29 - Hangers and Supports for Electrical Systems.
C Section 26 05 33.16 - Boxes for Electrical Systems.
D Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
E Section 26 27 26 - Wiring Devices: Receptacles for installation in poles.
F Section 26 28 13 - Fuses.

1.03 REFERENCE STANDARDS

A ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2017.
B IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 2013 (Corrigendum 2019).
C IEEE C2 - National Electrical Safety Code(R) (NESC(R)); 2023.
D IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).
E IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information; 2019.
F IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2019.
G IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.
H IES RP-8 - Recommended Practice: Lighting Roadway and Parking Facilities; 2021.
I NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
J NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 2000 (Reaffirmed 2006).
K NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Disharge Ballasts; 2020.
L NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012 (Reaffirmed 2018).
M NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
N UL 1598 - Luminaires; Current Edition, Including All Revisions.
O UL 1598C - Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits; Current Edition, Including All Revisions.
P UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A Coordination:

1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
2. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A Shop Drawings:

1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
2. Provide photometric calculations where luminaires are proposed for substitution.
3. Provide structural calculations for each pole proposed for substitution.

B Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.

1. LED Luminaires:
   a. Include estimated useful life, calculated based on IES LM-80 test data.
   b. Include IES LM-79 test report upon request.
2. Poles: Include information on maximum supported effective projected area (EPA) and weight for the design wind speed.

C Certificates for Poles and Accessories: Manufacturer's documentation that products are suitable for the luminaires to be installed and comply with designated structural design criteria.

D Field Quality Control Reports.

1. Include test report indicating measured illumination levels.

E Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

F Operation and Maintenance Data: Instructions for each product including information on replacement parts.

G Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Fuses: Five percent of total quantity installed for each type, but not less than two of each type.

H Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

1.06 QUALITY ASSURANCE

A Comply with requirements of NFPA 70.

B Maintain at the project site a copy of each referenced document that prescribes execution requirements.

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

D Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.

B Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 WARRANTY

A Provide three year manufacturer warranty for all LED luminaires, including drivers.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A Furnish products as indicated in luminaire schedule included on the drawings.

2.02 LUMINAIRES

A Provide products that comply with requirements of NFPA 70.

B Provide products that are listed and labeled as complying with UL 1598, where applicable.

C Provide products listed, classified, and labeled as suitable for the purpose intended.

D Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

F Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

H Recessed Luminaires:

1. Ceiling Compatibility: Comply with NEMA LE 4.
2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

I Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

J LED Luminaires:

1. Components: UL 8750 recognized or listed as applicable.
2. Tested in accordance with IES LM-79 and IES LM-80.
3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

K LED Tape Lighting Systems: Provide all power supplies, drivers, cables, connectors, channels, covers, mounting accessories, and interfaces as necessary to complete installation.

1. LED Tape - General Requirements:
   a. Listed.
   b. Designed for field cutting in accordance with listing.

c. Wet Location Applications: IEC 60529, IP 68 (waterproof) rated.

2.03 BALLASTS AND DRIVERS

A Ballasts/Drivers - General Requirements:

1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
3. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.

B Dimmable LED Drivers:

1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
2. Control Compatibility: Fully compatible with the dimming controls to be installed.

2.04 POLES

A All Poles:

1. Provide poles and associated support components suitable for the luminaire(s) and associated supports and accessories to be installed.
2. Material: Steel, unless otherwise indicated.
3. Shape: Square straight, unless otherwise indicated.
4. Finish: Match luminaire finish, unless otherwise indicated.
5. Mounting: Install on concrete foundation, height as indicated on the drawings, unless otherwise indicated.
6. Unless otherwise indicated, provide with the following features/accessories:
   a. Handhole, 3" x 5" in size.
   b. Anchor bolts with leveling nuts or leveling shims.
   c. Anchor base cover.

B Metal Poles: Provide ground lug, accessible from handhole or transformer base.

2.05 ACCESSORIES

A Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.

B Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

C Provide accessory plaster frames for luminaires recessed in plaster ceilings.

PART 3 EXECUTION

3.01 EXAMINATION

A Verify that field measurements are as indicated.

B Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C Verify that suitable support frames are installed where required.

D Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A Provide extension rings to bring outlet boxes flush with finished surface.

B Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of luminaires provided under this section.

B Perform work in accordance with NECA 1 (general workmanship).

C Install products in accordance with manufacturer's instructions.

D Install luminaires in accordance with NECA/IESNA 501.

E Provide required support and attachment in accordance with Section 26 05 29.

F Provide required seismic controls in accordance with Section 26 05 48.

G Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

H Recessed Luminaires:

1. Install trims tight to mounting surface with no visible light leakage.
2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

I Suspended Luminaires:

1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet in length, with no more than 4 feet between supports.
4. Install canopies tight to mounting surface.
5. Unless otherwise indicated, support pendants from swivel hangers.

J Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

K Pole-Mounted Luminaires:

1. Foundation-Mounted Poles:
   a. Install foundations plumb.
   b. Install poles plumb, using leveling nuts or shims as required to adjust to plumb.
   c. Tighten anchor bolt nuts to manufacturer's recommended torque.
   d. Install non-shrink grout between pole anchor base and concrete foundation, leaving small channel for condensation drainage.
   e. Install anchor base covers as indicated.
2. Embedded Poles: Install poles plumb as indicated.
3. Grounding:
   a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.
4. Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.

L Install accessories furnished with each luminaire.

M Bond products and metal accessories to branch circuit equipment grounding conductor.

N Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

A Inspect each product for damage and defects.

B Operate each luminaire after installation and connection to verify proper operation.

C Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 ADJUSTING

A Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B Luminaires with Field-Rotatable Optics: Position optics according to manufacturer's instructions to achieve lighting distribution as indicated or as directed by Architect.

3.06 CLEANING

A Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

3.08 PROTECTION

A Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 27 05 00
GENERAL REQUIREMENTS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK:

A The work of this Section consists of providing all required labor, supervision, materials and equipment (except equipment furnished by the Owner to be installed by the Contractor) to satisfactorily complete the work shown on the drawings and/or specified in all Sections of Division 27 and all other work and miscellaneous items, not specifically mentioned, but reasonably inferred for a complete and fully operating facility. The work shall include but not be limited to the following:

1. Furnish and install all required in-place equipment, conduits, conductors, cables and any miscellaneous materials for the satisfactory interconnection and operation of all associated communication systems.

1.02 RELATED WORK:

A This Section provides the basic Communication Requirements which supplement the General Requirements of Division 1 and apply to all Sections of Division 27.

1.03 STANDARDS AND CODES:

A All work and material shall be in compliance with and according to the requirements of the latest revision of the following standards and codes:

1. California Electrical Code (CEC)
2. American National Standards Institute (ANSI) Publications:
   a. C2-02 National Electrical Safety Code
3. Code of Federal Regulations (CFR):
   a. 29 CFR 1910.147 Control of Hazardous Energy (Lock Out/Tag Out)
4. Electronics Industries Association (EIA)
5. Building Industry Consultants Society International (BICSI)
6. Institute of Electrical and Electronics Engineers (IEEE)
7. National Electrical Testing Association (NETA):
   a. Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems, Standard ATS
8. National Electrical Manufacturers Association (NEMA)
9. Occupational Safety and Health Act (OSHA) Standards
10. State of California Public Utilities Commission:
    a. General Order 128 Rules for Construction of Underground Electric Supply and Communication Systems

B Variances: In instances where two or more codes are at variance, the most restrictive requirement shall apply.

C Underwriter Laboratories (UL) listing is required for all equipment and materials where such listing is offered by the Underwriters Laboratories. Safety labeling and listing by other organizations, such as ETL Testing Laboratories, may be substituted for UL labeling and listing if acceptable to the Owner. Provide service entrance labels for all equipment required by the NEC to have such labels.

1.04 SUBMITTALS:

A As specified in Division 1. Submit to the Engineer shop drawings, manufacturer's data and certificates for equipment, materials and finish, and pertinent details for each system specified. Obtain approval before procurement, fabrication, or delivery of the items to the job site. Partial submittals are not acceptable and will be returned without review.

B Submittals are required for all items, regardless of whether they are furnished as specified or are substituted.

C Submittals shall be provided prior to the purchasing and installation of the item(s) being submitted. Any work done prior to the final approval of the submittal shall be done at risk and any modifications, changes, or re-work that may be required resulting from the final submittal review shall be provided by the Contractor at no additional cost to the project.

D Information to be submitted includes manufacturer's name, trade name, equipment model number, nameplate data, equipment drawings including: size, layout dimensions and capacity, manufacturer's descriptive literature of cataloged products, diagrams, test data, and performance and characteristic curves as applicable. Furnish project specification and paragraph reference, applicable Federal, Industry and Technical Society Publication References, and years of satisfactory service of each item required to establish contract compliance. Photographs of existing installations and data submitted in lieu of catalog data are not acceptable and will be returned without approval.

E If submittal information includes multiple products, items being submitted for approval shall be clearly identified and Items not to be used on the project shall be clearly marked out. Submittals consisting of manufacturer's catalogs without clearly marking out items not being used will be returned as not reviewed.

F Organize submittals for equipment and items related to each specification section together as a package.

G Submit submittal packages in digital PDF format.

1. Certificates of Conformance: Submit manufacturer's certifications as required on products, materials, finish, and equipment indicated in the technical sections. Certifications shall be documents prepared specifically for this contract. Preprinted certifications and copies of previously submitted documents will not be acceptable. The manufacturer's certifications shall name the appropriate products, equipment, or materials and the publication specified as controlling the quality of that item. Certification shall not contain statements that imply the item does not meet requirements specified, such as "as good as", "achieve the same end use and results as materials formulated in accordance with the referenced publications;" or "equal or exceed the service and performance of the specified material." Certifications shall state that the item conforms to the requirements specified. Certificates shall be printed on the manufacturer's letterhead and shall be signed by the manufacturer's official, authorized to sign certificates of conformance.

H Substitutions:

1. The equipment included in the Contract Documents is used to establish standards of quality, utility, size, and appearance. Equipment which in the opinion of the Engineer is equal in quality, utility, size, and appearance will be approved as substitutions to that specified:

a. Products that are specified by manufacturer, trade name or catalog number establish a standard of quality and do not prohibit the use of equal products of other manufacturers provided they are approved by the Engineer prior to bidding.

2. Substitutions will be accepted for review where there is a reasonable reason for the substitution. Reasonable reasons include:
   a. Cost savings to the owner. Include deductive change order with submittal.
   b. A product with features providing additional benefits to the end user.
   c. Improved finished environment, lay out of the final installation, or space savings over the specified equipment.
   d. Delivery considerations.
   e. Owner's specific requests.
3. Where items are noted as "or equal", a product of equal design, construction, and performance will be considered.
4. Any item proposed as a substitute shall be accompanied by the following:
   a. Drawings and/or data giving sizes, capacities, all pertinent test data, catalog cut sheets, product information, and all other necessary information required to substantiate that the product is equal or exceeds that specified.
   b. A summary sheet noting each performance characteristic noted in the specification section or elsewhere in the contract documents of the specified product and the corresponding performance characteristics of the proposed substitution. The summary sheet shall contain the following information:
      1) Reason for Substitution Request
      2) Pertinent Performance Characteristics
      3) Specified Product Values
      4) Substituted Product Values
   c. Any substitution request that does not include the above information shall be rejected.
   d. Refer to the end of this specification section for an example form to be used for substituted products. A Microsoft Word version of the form can be provided to the Contractor for their use upon request.
5. Substitutions shall be equal, in the opinion of the Engineer, to the specified equipment. The burden of proof of such shall rest with the Contractor. When the Engineer in writing accepts a substitution, it is with the understanding that the Contractor guaranteed the substituted equipment to be equal to the one specified and dimensioned to fit within the construction. Approved substitutions shall not relieve the Contractor of responsibilities for the proper execution of the work, or from any provisions of the Plans or Specifications.
6. Contractor shall be responsible for coordination of the substituted products with other trades. Provide all additional connectivity, equipment, increased wire/conduit size, installation hardware, testing, and other miscellaneous appurtenances as required for a complete and fully functional installation.
7. Only one substitution will be considered for each product specified.
8. Alternate manufacturers must be submitted for approval 10 days prior to bid date unless noted otherwise in Division 1.

9. The Contractor shall be responsible for all expenses in connection with the substitution materials, process, and equipment, including the effect of his/her substitution on him/her, his/her subcontractor's or other Contractor's work. No substitution shall be permitted without written authorization of the Engineer. Any assumptions on the acceptability of a proposed substitution prior to acceptance by the Engineer are at the sole risk of the Contractor.

I Change Orders:

1. Where a change to the contract documents would result in a credit due to the Owner or a value add change to the project, provide a detailed change order request for the Engineer to review.
2. It shall be understood that the Engineer's review of costs associated with the change order shall not constitute approval of the change order or their associated costs. The Engineer's review shall be intended to assist the Owner in evaluating the costs associated with the change only. Final approval or rejection of the change order shall be at the discretion of the Owner.
3. Change order requests shall include the following information:
   a. Description of the change
   b. Reference to the document or written direction to make the change:
      1) In the case of design-team directed changes, reference the drawing/sketch number or RFI number.
      2) In the case of Owner-directed changes, reference the email, memo, or other written direction from the Owner and provide a copy of the direction.
   c. Detailed cost breakdown for the change:
      1) Line item for each material noting:
         (a) Material used (e.g. ¾" EMT)
         (b) Total quantity (e.g. 200lf)
         (c) Unit cost (e.g. $2/lf)
         (d) Total materials cost (e.g. $400)
         (e) Unit labor hours (e.g 6hrs/100lf)
         (f) Total labor hours (e.g. 12hrs)
         (g) Hourly rate (e.g. $90/hr)
         (h) Total labor cost (e.g. $1,080
         (i) Total labor hours for each position (e.g. Journeyman vs. Superintendent)
         (j) Total materials cost
         (k) Overhead
         (l) Profit
         (m) Total change order value (positive for value added changes, negative for credits)

J Closeout Submittals:

1. As-built drawings: Submit As-Built Record documents as in accordance with section 3.05 below.
2. Cost analysis: Submit final cost information including original bid and any change orders broken down by system, material and labor costs (as applicable):

a. Public Address System
b. CATV System
c. Telecom System
d. Data System
e. Assistive Listening System
f. Audio/Visual System

3. Operation and Maintenance Manuals. Furnish O & M Manuals for equipment where manuals are specified in the equipment specifications or are specified in Division 1. Electrical O & M Manuals shall include as a minimum:
   a. Copies of equipment supplied on the project.
   b. Instruction manuals including operation instructions and maintenance requirements/recommendations.
   c. List of suppliers for all equipment with addresses and telephone numbers.
   d. List of service support for all equipment with addresses and telephone numbers.
   e. Copies of all test reports required in Division 27 specification sections.
   f. Spare Parts: For each piece of equipment, submit a list of recommended spare parts. Include part numbers and the name, address, and telephone number of the supplier.
   g. Other closeout documentation and test results as required under other sections of the specifications.
   h. Provide in a single transmittal.
   i. Warranty for all work, including contractor's general warranty.
   j. All warranties begin as per the Contract, Division 1 or final acceptance of the Work by the Owner, Architect, Engineer, and Authority Having Jurisdiction, which ever is later:
      1) Manufacturer's Warrantees and Guarantees that are longer than the base contract/specified amount are to be provided with the manuals.
      2) The Contractor is responsible for all Warranty and Guarantee work whether or not the Manufacturer also Warrantees and Guarantees the product.

1.05 CONTRACT DOCUMENTS:

A Review the Drawings and Specification Divisions of other trades and perform the electrical work that will be required for the installations:
   1. Should there be a need to deviate from the Drawings and Specifications, submit written details and reasons for all changes to the Engineer for favorable review.
   2. All drawings and divisions of these specifications shall be considered as whole. This contractor shall report any apparent discrepancies prior to submitting bids.
   3. Should there be a conflict or discrepancy between the drawings and specifications, or between different drawings sheets, or between different specification sections, the most expensive option shall be required, at the discretion of the Engineer.

B Drawings:
   1. The Drawings shall govern the general layout of the completed construction:
      a. Locations of equipment, inserts, anchors, panels, pullboxes, manholes, conduits, stub-ups, fittings, outlets, racks, devices and ground connections are approximate unless dimensioned; verify locations with the Engineer prior to installation. Field verify scaled dimensions on Drawings.

b. The general arrangement and location of existing conduits, piping, apparatus, etc., is shown as existing on drawings or specified. The drawings and specifications are for the assistance and guidance of the contractor, exact locations, distances and elevations are governed by actual field conditions. Extreme accuracy of data given herein and on the drawings is not guaranteed. Minor changes may be necessary to accommodate work. The contractor is responsible for verifying existing conditions. Should it be necessary to deviate from the design due to interference with existing conditions or work in progress, claims for additional compensation shall be limited to those for work required by unforeseen conditions as determined by the Engineer.

1.06 COORDINATION:

A Coordinate the communications work with the other trades, code authorities, utilities and the Engineer:

1. Failure to accomplish this coordination is not a basis for additional cost reimbursement to the Contractor.
2. Coordinate does not mean to only send a Request For Information. Coordinate implies that the contractor is to take the lead in bringing all of the necessary organizations together to coordinate the work and to provide for the associated costs.

B Where connections must be made to existing installations, properly schedule all the required work, including the power or communication system shutdown periods. Schedule and carry out shutdowns so as to cause the least disruption to operation of the Owner's facilities:

1. Include costs for work during non-normal working hours and temporary facilities as may be required.
2. Include costs as necessary for sub-contractors to accomplish the specified work.

C When two trades join together in an area, make certain that no communications work is omitted. Failure to accomplish this coordination is not a basis for additional cost reimbursement to the Contractor.

D Operations:

1. Perform all work in compliance with Division 1:
   a. Keep the number and duration of power shutdown periods to a minimum.
   b. Show all proposed shutdowns and their expected duration on the construction schedule:
      1) If the construction schedule is created and maintained by others, make sure that the associated information is incorporated.
      2) Failure by the Contractor to properly schedule and plan for such activities is not a basis for additional compensation.
   c. Carry out shutdown only after the Engineer has favorably reviewed the schedule. Submit power/communications interruption schedule 15 days prior to date of interruption. Failure to provide schedule with adequate review time may result in rescheduling of the work at the Contractor's expense.

E Construction telephone:

1. See Division 1 Temporary Utilities.

F Storage:

1. Provide adequate storage for all equipment and materials which will become part of the completed facility so that it is protected from sun, weather, condensation, dust, water, or construction operations.

G Damaged Products:

1. Notify the Engineer in writing in the event that any equipment or material is damaged. Obtain approval from the Engineer before making repairs to damaged products.

H Order material in such a timely manner and after approval of the same so as to insure that the approved material is available to be installed on site in a timely manner. Additional costs or substitutions necessitated because the Contractor failed to order material in a timely manner are not reimbursable. Costs associated with processing of paperwork by the owner and design consultants resultant of such failures to coordinate the work by the Contractor shall have such costs reimbursed by the Contractor.

1.07 LOCATIONS

A General:

1. Use equipment, materials and wiring methods suitable for the types of locations in which they are located:
   a. Dry Locations:
      1) All those indoor areas which do not fall within the definition below for Wet Locations and which are not otherwise designated on the Drawings.
   b. Wet Locations:
      1) All locations exposed to the weather, whether under a roof or not, unless otherwise designated on the Drawings.

1.08 SAFETY AND INDEMNITY:

A The Contractor is solely and completely responsible for conditions of the job site including safety of all persons and properly during performance of the work. This requirement will apply continually and not be limited to normal working hours:

1. No act, service, drawing review or construction review by the Owner, the Engineer or their Consultants is intended to include reviews of the adequacy of the Contractors safety measures in or near the construction site.
2. The Contractor performing work under this Division of the Specifications shall hold harmless, indemnify, and defend the Owner, the Engineer, their consultants, and each of their officers, agents and employees from any and all liability claims, losses, or damage arising out of or alleged to arise from bodily injury, sickness, or death of a person or persons and for all damages arising out of injury to or destruction of property arising directly or indirectly out of or in connection with the performance of the work under this Division of the Specifications, and from the Contractor's negligence in the performance of the work described in the construction contract documents, but not including liability that may be due to the sole negligence of the Owner, the engineer, their Consultants or their officers, agents and employees.

PART 2 PRODUCTS

2.01 STANDARD OF QUALITY:

A Material and Equipment:

1. Provide materials and equipment that are new and are current products of manufacturers regularly engaged in the production of such products. The standard products shall have been in satisfactory commercial or industrial use for two years prior to bid opening. The two-year period includes use of equipment and materials of similar size under similar circumstances. For uniformity, only one manufacturer will be accepted for each type of product.

B Service Support:

1. Submit a certified list of qualified permanent service organizations including their addresses and qualification for support of the equipment. These service organizations shall be convenient to the equipment installation and able to render service to the equipment on a regular and emergency basis during the warranty period of the contract.

C Manufacturer's Recommendations:

1. Where installation procedures are required to be in accordance with manufacturer's recommendations, furnish printed copies of the recommendations prior to installation. Installation of the item shall not proceed until recommendations are received. Failure to furnish recommendation shall be cause for rejection of the equipment or material.

2.02 NAMEPLATES:

A For each piece of electrical equipment, provide a manufacturer's nameplate showing his name, location, the pertinent ratings, the model designation, and shop order number.

B Additionally, identify each piece of equipment and related controls with a rigid laminated engraved plastic nameplate. Unless otherwise noted, nameplates shall be melamine plastic 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be 1 by 2.5 inches unless otherwise noted. Where not otherwise specified, lettering shall be a minimum of 0.25 inch high normal block style. Engrave nameplates with the inscriptions indicated on the Drawings and, if not so indicated, with the equipment name. Securely fasten nameplates in place using two stainless steel screws or, where favorably reviewed by the Engineer, with epoxy cement. Where no inscriptions are indicated on the Drawings, furnish nameplates with appropriate inscriptions furnished by the Engineer upon prior request by the Contractor. At a minimum, these nameplates shall be provided for:

1. MDF Racks / Cabinets
2. IDF Racks / Cabinets
3. Signal Termination Cabinets (STC)
4. Headend equipment (e.g. Clock/PA headend)

2.03 FASTENERS:

A Fasteners for securing equipment to walls, floors and the like shall be either hot-dip galvanized after fabrication or stainless steel.

2.04 FINISH REQUIREMENTS:

A Equipment:

1. Refer to each electrical equipment section of these Specifications for painting requirements of equipment enclosures. Repair any final paint finish which as been damaged or is otherwise unsatisfactory, to the satisfaction of the Engineer.

B In finished areas, paint all exposed conduits, boxes and fittings to match the color of the surface to which they are affixed.

PART 3 EXECUTION

3.01 INSTALLATION:

A Ensure that all equipment and materials fit properly in their installation.

B Perform any required work to correct improperly fit installation at no additional expense to the owner.

C Equipment Installation:

1. Provide the required inserts, bolts and anchors, and securely attach all equipment and materials to their supports.
2. Mount all metal panels which are mounted on or abutting concrete walls or any outside walls a minimum of ¼ inch from the wall, and paint the back sides of the panels with Bituminous Coating, Rust-oleum C9578 Coal Tar Epoxy Coating or approved equal. Film thickness shall be 10 mils minimum.

D Cutting, Drilling and Welding:

1. Provide the required cutting, drilling welding that is required for the electrical construction work. Comply with Division 1 requirements.
2. Structural members shall not be cut or drilled, except after approval by the Engineer. Use a core drill wherever it is necessary to drill through concrete or masonry.
3. Provide the required welding for equipment supports. Conduits and fittings shall not be welded to structural steel. Where welding is required, it shall be accomplished by tradesmen certified to do such work. Provide fire and other protection as appropriate.

3.02 FIELD TESTS:

A Test shall be in accordance with Acceptance Testing recommendations issued by the NIA/TIA for telecommunications equipment and the manufacturers recommendations for equipment other than telephone or data systems.

B Perform equipment field tests and adjustments. Properly calibrate, adjust and operationally check all components, and demonstrate as ready for service. Make additional calibration and adjustments if it is determined later that the initial adjustments are not satisfactory for proper performance. Perform equipment field test for equipment where equipment field tests are specified in the equipment Specifications. Give sufficient notice to the Engineer prior to any test so that the tests may be witnessed.

C Provide instruments, other equipment, temporary facilities as may be necessary, and material required for the tests. These shall be of the type designed for the type of tests to be performed and shall be calibrated by a recognized testing laboratory within three months prior to testing.

D Operational Tests: Operationally test all drops to demonstrate that the circuits and equipment have been properly installed and adjusted and are ready for full-time service. Demonstrate the proper functioning of drops in all modes of operation.

E Re-testing will be required for all unsatisfactory tests after the equipment or system has been repaired. Re-test all related equipment and systems if required by the Engineer. Repair and re-test equipment and systems which have been satisfactorily tested but later fail, until satisfactory performance is obtained.

F Perform calibration and adjustment on all equipment. Where the values for adjustment are not shown on the Drawings, obtain the proper values from the Engineer.

G Maintain records of each test and submit five copies to the Engineer when testing is complete. All tests shall be witnessed by the Engineer. These records shall include:
1. Name of equipment tested.
2. Date of report.
3. Date of test.
4. Description of test setup.
5. Identification and rating of test equipment.
6. Test results and data.
7. Name of person performing test.
8. Owner or Engineer's initials.

H Items requiring testing as a minimum:
1. Data system.
2. Telephone system.
3. Intercom/PA system.
4. CATV system.
5. Sound/Assistive listening system.
6. Audio/Visual system.

3.03 PAINTING OF EQUIPMENT:

A Factory Applied: Communication equipment shall have factory applied painting system which shall, as a minimum, meet the requirements of NEMA ICS 6 corrosion-resistance test and the additional requirements specified in the technical section.

B Field Applied: Paint communication equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria.

3.04 SIGNAGE AND IDENTIFICATION:

A Identify system components, wiring, and cabling complying with TIA-606-B.

B Paint and label colors for equipment identification shall comply with TIA-606-B for Class 1 (C1 - single telecom room) and Class 2 (C2 - multiple telecom rooms) level of administration including optional identification requirements of this standard.

C Nameplate Mounting:
1. Provide number, location and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two stainless steel sheet-metal screws or two rivets.

3.05 RECORDS:

A Maintain one copy of the contract Drawing Sheets on the site of the work for recording the record "as built" condition. After completion of the work, the Contractor shall neatly and carefully mark the work as actually constructed, revising, deleting and adding to the Drawing Sheets as required. The following requirements shall be complied with:
1. Drawings and associated as-built changes shall be completed in AutoCAD or Revit and submitted in CAD/Revit as well as PDF format. Documents with hand-written changes or with RFI responses and field sketches pasted on shall not be acceptable. Engineer shall make digital backgrounds of original contract documents available for Contractor's use upon request.
2. Cable Size and Type: Provide the size and type of each cable installed on the project.

3. Substructure: Where the location of duct lines, adjacent utilities, cable boxes, and manholes are found to be different than shown, carefully mark the correct location on the Drawings. Work shall be dimensioned from existing improvements.
4. Record (As Built) Drawings: At the completion of the Work the Contractor shall provide a set of record "as built" drawings over to the Owner for his use.
   a. Record drawings are required to be transmitted within 30 days of beneficial occupancy.
   b. Transmittal and approval process:
      1) Contractor is to transmit one printed copy for review and comment.
      2) After acceptance of the above, the Contractor is to transmit three printed sets and one reproducible set.
      3) Contractor to provide information on their company in the margin of record drawings along with the date of the revisions and the associated revision number.

3.06 POSTED OPERATING INSTRUCTIONS:

A Provide for each system and principal item of equipment as specified in the technical sections for use by operation and maintenance personnel. The operating instructions shall include the following:
1. Single line diagrams, wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
2. Start up, proper adjustments, operating and shutdown procedures.
3. Safety precautions.
4. The procedure in the event of equipment failure.
5. Other items of instruction as recommended by the manufacturer of each system or item of equipment.

3.07 INSTRUCTION TO OWNER'S PERSONNEL:

A Where specified in the technical sections, furnish the services of competent instructors to give full instruction to designated personnel in the adjustment, operation and maintenance of the specified systems and equipment, including pertinent safety requirements as required. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or systems has been accepted and turned over to the Owner for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the individual section. When more than 4 man-days of instruction are specified, use approximately half of the time for classroom instruction. Use other time for instruction with equipment or system. When significant changes or modifications in the equipment or system are made under the terms of the contract, provide additional instructions to acquaint the operating personnel with the changes or modifications.

B Contractor shall video record all training sessions and shall provide the Owner with a copy of the recording at the conclusion of the training. Recording shall be in digital video format (MP4, AVI, or similar) and shall be provided on USB stick or DVD labeled with the Contractor's contact information, the training topic, and date of training.

C Contractor shall maintain an attendance sheet from each session which contains the following information:
1. Attendees with associated arrival and departure time.

2. Topics covered.
3. Information provided.
4. Signatures of attendees taken at the completion of the session.

3.08 CLEAN UP:

A Thoroughly clean all soiled surfaces of installed equipment and materials.

B Upon completion of electrical work, remove all surplus materials, rubbish, and debris that accumulated during the construction work. Leave the entire area neat, clean, and acceptable to the Engineer.

END OF SECTION

SECTION 27 10 00
WIRE AND CABLES FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK:

A The work of this Section consists of providing all wire and cable rated 600 volts or less, including splices and terminations, as shown on the Drawings and as described herein.

1.02 RELATED WORK:

A See the following Specification Section for work related to the work in this Section:

1. 27 05 00 General Requirements for Communication Systems
2. 26 05 33.13 Conduit for Electrical Systems
3. 26 05 33.16 Boxes for Electrical Systems
4. 26 05 26 Grounding and Bonding for Electrical Systems

1.03 STANDARDS AND CODES:

A Work and materials shall be in compliance with and according to the requirements of the latest revision of the following Standards and Codes:

1. American Society for Testing and Materials (ASTM):
   a. B3-01, Specification for Soft or Annealed Copper Wire
   b. B8-99, Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard or Soft
   c. B173-01a, Specification for Rope-Lay-Stranded Copper Conductors Having Concentric-Stranded Members, for Electrical Conductors
2. Federal Standards (FED. STD.):
   a. 228, Methods of Testing Insulated Cable and Wire
3. Federal Specifications (FS):
   a. A-A-59544, Cable and Wire, Electrical
   b. A-A-55809, Pressure Sensitive Electrical Plastic Insulation Tape
4. National Electrical Manufacturers Association (NEMA):
   a. WC 70-1999/ICEA S-95-658-1999, Cross-Linked Thermosetting Polyethylene, Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
5. National Fire Protection Association (NFPA), National Electrical Code (NEC) - Latest Revision
6. California Electrical Code (CEC)
7. Underwriters Laboratories (UL):
   a. 44-83 (R1988), Rubber-Insulated Wires and Cable
   b. 83-1983 (R1989), Thermoplastic-Insulated Wires and Cables
   c. 510-1986, Insulating Tape

1.04 SUBMITTALS:

A As specified in Division 1 and Section 27 05 00.

1. Catalog Data: Provide manufacturer's descriptive literature.
2. Single Submittal: A single complete submittal is required for all products covered by this Section.

PART 2 PRODUCTS

2.01 CONDUCTORS:

A General: Conductors shall be copper, Class B stranded and of the sizes indicated. All conductors 120 volts and above shall be in raceway unless otherwise noted. Minimum power and control wire size shall be No. 12 AWG unless otherwise specified by the Owner's Representative. All cable used on this Project shall be of the same type and conductor material.

B Unless otherwise noted, conductors #6 and larger shall be XHHW insulation suitable for operation in wet or dry locations at temperatures not to exceed 75C in wet locations and 90C in dry locations. Conductors #8 and smaller shall be THHN in dry locations and THWN/THHN in wet locations. Control Cable shall be THHN.

C Insulation Marking: All insulated conductors shall be identified with printing colored to contrast with the insulation color.

D Color Coding: As specified in paragraph 3.03.

E Special Wiring: Where special wiring is proposed by an equipment manufacturer, submit the special wiring requirements to the Owner's Representative and, if approved, provide same. Special wire shall be the type required by the equipment manufacturer.

F Other Wiring: Wire or cable not specifically shown on the Drawings or specified, but required, shall be of the type and size required for the application and as approved by the Owner's Representative.

G Terminations:

1. Cable Termination for Copper: Crimp style two hole NEMA spade terminals designed and rated for copper cable.
2. Wire Terminations: Crimp on ring-tongue terminals, insulated sleeve, of proper size for the wire used.
3. End Seals: Heat shrink plastic caps of proper size for the wire on which used.
4. Manufacturer: T&B, Burndy or approved equal.

H Manufacturer: BICC General Cable Inc., Southwire, or approved equal.

2.02 TELEPHONE AND DATA STATION DROP CABLE:

A General:

1. Station Drop Cable refers to MDF-to-jack and IDF-to-jack wiring topology
2. Conductor Identification: Conductors shall be pigmented “White/Blue; White/Orange; White/Green & White/Brown.”
3. Cable for all exterior, underground or wet locations shall be outdoor rated with water-blocked construction, sunlight and moisture resistance jacket.
4. Cable for all interior plenum locations. Cable shall have Fluorinated Ethylene-Propylene insulation with flame retardant PVC Jacket.
5. Cable for all interior non-plenum locations. Cable shall have Polyolefin insulation with flame retardant PVC Jacket.
6. Jacket Color:
   a. Data cables: Blue
   b. Telephone cables: White

B Category 6 Unshielded Twisted Pair (UTP) cable (For Data Jacks):

1. 100-Ohm, 23 AWG, Category 6 4-pair balanced unshielded twisted pair solid annealed copper conductors.
2. Cable shall be guaranteed to exceed all TIA-568 link and channel performance requirements and be capable of supporting 1000Base-T (802.3ab) and ISO/IEC 11801 Class E applications for a total distance of 100 meters with equipment cords.
3. Cable shall be characterized to 550 MHz and UL/ETL Listed by the Manufacturer printed on the cable jacket and package, as well as ETL Verified to TIA-568 Category 6 and ISO/IEC 11801 Class E.
4. Outer Diameter: 0.230" max.
5. Cable shall be provided on spools or reels-in-box to reduce risk of kinking cable upon deployment, shall be made by an ISO 9001 and 14001 Certified Manufacturer, and shall be guaranteed to meet or exceed Channel margin characteristics as stated above under Performance.
6. Performance:
   a. Insertion loss: 3%
   b. NEXT: 6 dB
   c. PSNEXT: 6 dB
   d. ACR-F (ELFEXT): 8 dB
   e. PSACR-F (PSELFEXT): 9 dB
   f. Return Loss: 3 dB
   g. ACR-N: 7 dB
   h. PSACR-N: 8 dB
7. Manufacturer:
   a. Interior plenum locations: Panduit PUR6C04BU-U, district standard, no substitutions

C Category 6A Unshielded Twisted Pair (UTP) cable (for Wireless Access Point Jacks):

1. Cable shall be 100-Ohm, 23 AWG, Category 6A 4-pair balanced unshielded twisted pair solid annealed copper.
2. Cable shall be guaranteed to exceed all TIA-568 link and channel performance requirements, and capable of supporting 10GBase-T (802.3an) and ISO/IEC 11801 Class EA applications for a total distance of 100 meters with equipment cords. System is guaranteed to meet all CAT6A requirements for short links and channels down to a 10 foot permanent link (5 meter channel) with a guaranteed 5 dB margin of Alien Crosstalk. Field testing is not required for Alien Crosstalk clearance.
3. Cable shall be characterized to 750 MHz and UL/ETL Listed by the Manufacturer printed on the cable jacket and package, as well as Intertek (ETL) Verified to TIA-568 Category 6A and ISO/IEC 11801 Class EA requirements for channel, link and component performance to support IEEE 10GBASE-T (802.3an) networks
4. Manufacturer shall provide documentation from an independent third-party testing agency that verifies through random sampling that cable components perform at or above the levels contained on their product specifications.
5. The unshielded twisted pair conductors shall be surrounded by a non-conductive aluminum/polyester tape and jacketed with flame-retardant polymer alloy.
6. Outer Diameter: 0.275" max.

7. Cable shall be provided on spools or reels-in-box to reduce risk of kinking cable upon deployment, shall be made by an ISO 9001 and 14001 Certified Manufacturer, and shall be guaranteed to meet or exceed Channel margin characteristics as stated above under Performance.
8. Performance:
   a. Insertion loss: 3%
   b. NEXT: 4 dB
   c. PSNEXT: 5 dB
   d. ACR-F (ELFEXT): 8 dB
   e. PSACR-F (PSELFEXT): 8 dB
   f. Return Loss: 4 dB
   g. ACR-N: 7 dB
   h. PSACR-N: 7 dB
   i. PSANEXT: 4 dB
   j. PSAACR-F: 10 dB
9. Manufacturer:
   a. Interior plenum locations: Panduit PUR6AV04BU-G, district standard, no substitutions

2.03 TAPE:

A Tape used for cable marking shall be compatible with the insulation and jacket of the cable and shall be of plastic material. Tape shall conform to FS HH-I-595 and UL 510.

PART 3 EXECUTION

3.01 CABLE INSTALLATION:

A Clean Raceways: Clean all raceways prior to installation of cables as specified in Section 27 05 28.33 – Communication System Raceways and Fittings.

B Cable Pulling: Exercise care in pulling wires and cables into conduit or wireways so as to avoid kinking, putting undue stress on the cables or otherwise abrading them. No grease will be permitted in pulling cables. Only soapstone, talc, or UL listed pulling compound will be permitted. The raceway construction shall be complete and protected from the weather before cable is pulled into it. Swab conduits before installing cables and exercise care in pulling, to avoid damage to conductors.

C Bending Radius: Cable bending radius shall be per applicable code or standard, whichever is more stringent.

D Splices: Install cables in one continuous length. Splices shall not be permitted.

E Equipment Grounding Conductors: Provide an equipment grounding conductor, whether or not it is shown on the Drawings, in any conduit or any raceway.

F Wiring at Hinges: For cables crossing hinges, utilize extra flexible stranded wire, make up into groups not exceeding 12, and arrange so that they will be protected from chafing when the hinged member is moved.

G Damaged Cables: Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

H Cold Weather Installation: Bring cable to room temperature before de-reeling. Heat lamps shall not be used for heating cable.

I Service Loops: In communications rooms where cables are terminated, install a 10-foot long service loop on end of each cable prior to termination.

J All wiring and cable shall be supported from the structure above. All wiring over 100 volts shall be installed in conduit except as noted in Section 27 05 28.32. All wiring below 100 volts shall be installed in conduit unless otherwise noted.

K Low Voltage Cables:

1. All cables provided inside buildings shall be plenum rated.
2. All cables provide outside buildings shall be outdoor rated, gel filled cables.
3. All low voltage wires and cables concealed in walls shall be run in EMT conduit from flush outlet boxes to above accessible ceilings. Provide conduit where cables penetrate floors and fire walls above ceilings. Where low voltage cables run parallel to line voltage (over 120 volts), they shall be installed a minimum of 12 inches apart.
4. Contractor installing cables shall be manufacturer certified to pull and install cables of the types and ratings noted herein.
5. Maximum horizontal cabling distance for Copper data cables shall not exceed 295 feet per EIA/TIA 568B Standards. Contractor shall notify engineer prior to commencement of work of any cabling exceeding the 295 foot maximum distance.
6. Do not bend cables to a radius of less than eight (8) times the cable diameter.
7. All cables shall be provided with plastic identification tags in each end, identify the source of the cables and the destination of the cables.

3.02 CABLE TERMINATIONS AND SPLICES:

A Splices:

1. All fdata wiring shall be continuous from end to end. No splices shall be permitted.
2. Use UL listed wirenuts for line voltage branch circuits in dry locations.

B Terminations: Shall comply with the following:

1. Make up and form cable and orient terminals to minimize cable strain and stress on device being terminated on.
2. Burnish oxide from conductor prior to inserting in oxide breaking compound filled terminal.

3.03 FIELD TESTS

A Refer to individual system specification sections for testing requirements.

END OF SECTION

SECTION 27 20 00
DATA COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK:

A The work of this Section consists of providing components for the data communication systems. Provide racks, cabinets, pathways, boxes, cabling, terminations, patch cords, patch panels, jacks and testing as required.

1.02 RELATED WORK:

A See the following specification sections for work related to the work in this Section:
1. 27 05 00 General Requirements for Communication Systems
2. 27 10 00 Wire and Cables for Communication System
3. 26 05 26 Grounding and Bonding for Electrical Systems

1.03 STANDARDS AND CODES:

A Work and materials shall be in compliance with and according to the requirements of the latest revision of the following standards and codes:
1. American National Standards Institute (ANSI) Standards:
   a. ANSI X3T9.5 Fast Ethernet 100Base-T LAN: Defines standard for 100 Mb/s LAN based on either Fiber Optic cable or Unshielded Twisted Pair (UTP)
2. Telecommunications Industry Association / Electronic Industries Alliance (TIA/EIA) Standards:
   a. TIA/EIA 455 Reference Guide for Fiberoptic Testing Procedures
   b. TIA/EIA 472 General Specifications for Fiberoptic Cables
   c. TIA/EIA 492 Generic Specification for Optical Waveguide Fibers
   d. TIA/EIA 568B Commercial Building Telecommunications Cable Standard
   e. TIA/EIA 569A Commercial Building Standard for Telecommunications Pathways and Spaces
   f. TIA/EIA 598 Fiber Optic Cable Color Coding
   g. TIA/EIA 606 Administrative Standard for the Telecommunications Infrastructure of Commercial Buildings
   h. TIA/EIA 607 Commercial Building Grounding and Bonding Requirements for Telecommunications
3. Institute of Electrical and Electronics Engineers, Inc. (IEEE) Standards:
   a. IEEE 802.3 Ethernet 10Base-T LAN: Defines media and distance requirements for 10Mb/s LAN (issued in October 1990)
   b. IEEE 802.3z Gigabit Ethernet 1000Base SX and LX LAN: Defines media and distance requirements for 1000Mb/s LAN
4. Underwriters Laboratories (UL) Standards:
   a. UL 910 Test method of Fire and Smoke Characteristics of Electrical and Optical Cables Used in Air Handling Spaces
   b. UL 1666 Standard Flame test for Flame Propagation Height of Electrical and Optical Cable Installed Vertically in Shafts

1.04 QUALIFICATIONS:

A The telecommunications contractor shall have at least five years experience providing similar work, and shall provide a minimum of five references for similar projects completed with the last five years.

B The telecommunications installer(s) shall be certified category 5e and fiber optic cable installer(s) and shall provide proof of certification.

1.05 SUBMITTALS:

A Shop Drawings - In accordance with Section 27 05 00.

B Submit the following items:

1. Manufacturer's Catalog Data: Manufacturer's original catalog cuts and original description of data of all material and equipment with sufficient information provided so that the exact function of each device is known.
2. Description of conductors to be used with a statement that all wire shall be in conduit.
3. Floor plan of the point to point connections.
4. Diagram of the wiring circuitry.
5. Riser diagram.

C Single Submittal: A single complete submittal is required for all products covered by this Section.

D Closeout Submittals: Submit operation and maintenance data for all components of the telecommunications equipment specified herein. Submit certified test results. Submit in accordance with Division 1.

1.06 WARRANTY:

A Manufacturer shall provide a one year warranty for all system components.

PART 2 PRODUCTS

2.01 DATA SWITCHES:

A All active equipment such as data switches, hubs and/or routers will be furnished by the owner, installed by the contractor.

2.02 UTP DATA WIRE TERMINATION PANELS (PATCH PANELS):

A Minimum performance specifications:

1. Data Patch Panels: Must meet requirements for Category 6 of TIA/EIA.
2. Wireless Access Point Patch Panels: Must meet requirements for Category 6A of TIA/EIA.

B Provide standard 8-pin, 8-position, RJ-45 style modular patch panels with printed circuit board IDC 110-type connectors, capable of 4-pair, UTP cable termination and wired in an TIA/EIA configuration. Connector spring wire contacts shall be phosphor bronze plated with 50 microinches of gold over 100 microinches of nickel.

C Panels shall be mountable in a standard 19-inch equipment rack with capacity for up to 48 modular RJ-45 ports. Ports shall have individual numbers and white labels. Panels shall be UL listed and labeled Cat 6 (for Data) or 6A (for Wireless Access Points). Provide minimum of 20% spare port capacity.

D Provide cable management retaining brackets on the back of the panels or other means of securing cables being terminated. Horizontal wire management devices to be placed between each patch panel.

E Manufacturer:

1. 24 Port: Panduit CPPL24WBLY Mini-Com® Patch Panel w/labels, 24 Port, 1 RU, BL, district standard, no substitutions
2. 48 Port: Panduit CPPL48WBLY Mini-Com® Patch Panel w/labels, 48 Port, 2 RU, BL, district standard, no substitutions

2.03 UTP DATA PATCH CORDS:

A Provide four pair UTP 24 AWG solid copper. Cable shall be PVC rated. Cross-connect patch cords used on "DATA" cross-connects must meet the impedance, attenuation and NEXT requirements for Category 6 (for Data) or 6A (for Wireless Access Points) horizontal cable of TIA/EIA.

B Provide one patch cord for each patch panel for each data outlet.

C Patch cords shall be standard manufacture's length, minimum 5 feet.

D Patch cords shall be factory manufactured with protective strain relief boot on each male plug, hand crimping is not acceptable.

E Coordinate cross connections with Owner's representative.

F Manufacturer: Panduit, district standard, no substitutions.

2.04 MODULAR DATA OUTLETS (FOR DATA JACKS):

A Unless otherwise noted, provide single gang, modular voice/data outlets.

B Data Jacks must meet the minimum performance specifications for Category 6 of TIA/EIA. All 8-position, modular jack inserts for data locations shall comply with TIA/EIA T568B specifications.

1. Modular jacks shall be engraved 'CAT 6' on the face of the jack insert.

C Contractor shall coordinate data wiring scheme (T568B or T568A) with owner.

D All components shall be UL listed.

E Unless otherwise indicated provide insert and faceplate colors:

1. Single gang wall plate, white with two labels and label covers.
2. Provide 4 port unless otherwise noted, coordinate number of ports with drawings.
3. Data jack, blue.
4. Blank jack (where applicable), white.

F Manufacturer:

1. Data: CJ688TGBU Mini-Com® UTP RJ45 Cat 6 TG Jack Module, Blue (Data Drop), district standard, no substitutions.
2. Phone: CJ688TGWH Mini-Com® UTP RJ45 Cat 6 TG Jack Module, White (Phone Drop), district standard, no substitutions.
3. Clock/Speaker: CJ688TGGR Mini-Com® UTP RJ45 Cat 6 TG Jack Module, Green (Clock and Speaker Drop), district standard, no substitutions.
4. Wireless Access Point (In Patch Panel): CJ6X88TGBLK Mini-Com® UTP RJ45 Cat 6A TG Jack Module, Black (Wireless Drop in MDF/IDF), district standard, no substitutions.

2.05 MODULAR DATA OUTLETS (FOR WIRELESS ACCESS POINTS):

A Unless otherwise noted, provide field-terminable plug with RJ-45 connector.

B Field-terminable plug must meet the minimum performance specifications for Category 6A of TIA/EIA. All 8-position, modular jack inserts for data locations shall comply with TIA/EIA T568B specifications.

C Contractor shall coordinate data wiring scheme (T568B or T568A) with owner.

D All components shall be UL listed.

E Field-terminable plug shall terminate directly into the back of the Wireless Access Point.

F Manufacturer: Panduit FP6X88MTG RJ45, Cat 6A UTP Field Term Plug, 22-26 AWG (Wireless AP), district standard, no subtitutions.

2.06 FACEPLATES

A Faceplates shall accept flat modular data jacks.

B Material shall be plastic.

C (2) horizontal inset label locations shall be provided, top and bottom.

D Manufacturer:

1. Single Jack: Panduit CFPL1WHY Mini-Com® Single Gang Faceplate, 1 Port, White, district standard, no subtitutions.
2. Dual Jack: Panduit CFPL2WHY Mini-Com® Single Gang Faceplate, 2 Port, White, district standard, no subtitutions.

PART 3 EXECUTION

3.01 CABLE & WIRE INSTALLATION:

A General:

1. All data communications cables shall be terminated and tested under this contract.

B Station Cables:

1. Install station cabling, outlets and jacks as detailed on the Drawings. The typical configuration for most outlets is two unshielded twisted pair (UTP) cables of 4 pairs each.
2. Each data outlet shall be clearly marked with the MDF/IDF, patch panel and port number to which they are connected.

3.02 QUANTITIES AND LOCATIONS OF ITEMS:

A Location and placement of splices, patch panels and other distribution hardware shall be as shown on the Drawings or defined herein. Where Drawings are not specific as to placement, refer below.

B Quantities of racks, cabinets, splices and patch panels shown on the drawings are illustrative only and are meant to indicate the general configuration of the work. The contractor is responsible for providing the correct quantities of racks, patch panels, connectors and appurtenances necessary to terminate, cross connect and patch the volume of cable described herein and shown on the Drawings. Where less than all of the capacity of a patch panel is used to terminate cables, the Contractor shall provide the Owner with the number of connecting blocks, coupling panels, and couplings to completely fit out the patch panel:

1. Properly install freestanding equipment mounting rack(s), securely mounted to floor, walls and structure above to meet all sway bracing and seismic requirements:
   a. Cable tray shall be installed directly above rack. Brace tray to walls and structure above.
2. Provide lockable wall mounted equipment cabinets securely mounted to walls.
3. Rack mount Fiber Optic Patch Panels and UTP Patch Panels installed at locations as noted on the drawings. Complete with all necessary hardware.
4. MDF/IDF patch panels for station outlets shall be clearly marked to indicate the room/location served by each port.

3.03 CABLE TERMINATIONS:

A Fiber Optic cables:

1. After dressing the cable to its final destination, sheath shall be removed to a point that allows the conductors to be splayed and terminated in a neat and uniform fashion. At this point all fibers will be terminated in strict compliance with the manufacturers instructions.
2. Terminate both ends of each fiber optic cable with a SC type port, per manufacturer's recommendations. After termination, mount all connectors in fiber optic termination panels and label appropriately.

B UTP cables:

1. Each cable shall be terminated on an 8-pin modular jack as indicated in this specification section. Terminate each cable on an TIA/EIA T568 compliant outlet jack matching the cable's specification.
2. Cable pair twists shall be maintained up to within 0.25 inch of the point of termination. Under no circumstances shall cable pairs be untwisted or otherwise altered prior to termination.

3.04 INSTALLATION OF WALL PLATES:

A General - Plates shall match the style of the device and shall be plumb within 1/16-inch of the vertical or horizontal.

B Interior Locations, Finished Walls: Install non-metallic plates so that all four edges are in continuous contact with the finished wall surfaces. Plaster filling will not be permitted. Oversized plates or sectional plates are not acceptable and shall not be used. If wall finish will not accommodate proper mounting of the plate, the situation shall be brought to the attention of the architect and the wall finish replaced appropriately.

C Interior Locations, Unfinished Walls: Install stainless steel.

D Future Locations: Install blanking cover plates on all unused outlets.

E Prior to installation, coordinate labeling conventions with owner. Provide typed label(s) for faceplate, indentifying each jack on faceplate, uniquely identifying source and circuit number supplying jack, unless otherwise noted.

3.05 GROUNDING:

A Provide dedicated ground at MDF and each IDF. Bond all equipment to ground with insulated ground conductors.

3.06 TESTING:

A Fiber Optic Cable Testing:

1. Pre-installation testing:
   a. Fiber Optic cables: Perform visible light continuity checks on each fiber. If one end is not accessible: perform OTDR test to assure fiber continuity.
2. Post installation testing:
   a. After installation of connectors, visually inspect each fiber end-face at 10x magnification. Refinish fibers with visible defects and/or striations in the core area.
   b. Perform end-to-end, bi-directional attenuation (loss) test for each fiber strand at 850 NM and 1300 NM wavelengths. Conduct tests in accordance with TIA/EIA-526-14, Method B and with test instrument manufacturers' printed instructions.
   c. Demonstrate that measured link loss does not exceed the "worst case" allowable loss which is defined as the sum of: the connector losses (based on the number of mated

connector pairs at the TIA/EIA-568 maximum allowable loss) and the Fiber Optic cable loss (based on length and the TIA/EIA-568 maximum allowable loss.)

d. Strands whose measured attenuation fall outside the acceptable range shall be subject to further inspection and testing to determine the nature of the fault. At a minimum, an OTDR shall be used to: determine the-true loss for each connector pair, the exact length of the fiber and to identify the absence of any core damage,

e. Faults related to connectorization shall be corrected, and the fiber re-tested as stated in prior paragraphs above, until acceptable attenuation measurements are recorded.

f. Where defects are found inherent-in the fiber itself - replace any cable having fewer than the manufacturers guaranteed number of serviceable fibers.

g. Submit the following information regarding the Fiber Optic cable testing:

1) Cable number, fiber count, individual fiber numbers, connector types, number of connectors/ patches, calculated maximum link loss, length of run, measured link loss for each fiber.

3. Recommended test equipment (obtain approval of Owner prior to using substitute test equipment):

a. Fiber Optic power meter and Light Source: Siecor CPM-850/1300 meter and OS-100D Light Source or approved equal.

b. OTDR: Tektronix TFP2 FiberMaster, Easer Precision TD-2000 or equal with 850 NM and 1300 NM emitter modules and hard copy printout or approved equal.

c. Fiber Optic inspection scope: Cambridge Instruments 10X fiber-scope or approved equal.

B Paired and Multi-Conductor UTP Cable Testing:

1. After terminating both ends of all UTP cables, but before any cross connects are installed, test all UTP station cables for attenuation and cross-talk (NEXT) to 100 MHz. Test all UTP cables for continuity, ground fault, proper cross-connection, shorts and crossed pairs.

2. After installing cross-connects, perform end-to-end testing of each cross connected cable pair for continuity, ground fault, proper cross-connection, shorts and crossed pairs.

3. For multi-pair cables: For 100 pair or smaller replace entire cable if bad pair is found. For larger pair count cables, replace if more than 1% of pairs are bad.

4. Submit the following information regarding the UTP station cable testing:

a. Cable number, cable type, pair or conductor count; individual pair or conductor numbers; number of cross connects and/or patches in each pair; results of each test for each pair or conductor; total number of serviceable pairs or conductors in cable.

b. Information required above shall be provided in printed format only.

5. Recommended test equipment (Contractor shall obtain approval of Owner in writing prior to using substitute test equipment):

a. Fluke DSP 1100 SR, no known equal. Equipment shall be equipped with latest software. Contractor shall refer to Owner to obtain required set-up parameters.

3.07 ACCEPTANCE:

A Upon receipt of the Contractor's documentation of proposed cable testing, the Owner will have the right to review and observe the installation and randomly request tests of the cables/wires

installed. Once the testing has been completed and the Owner is totally satisfied, that all work is in accordance with the Contract Documents, the Owner will notify the Contractor in writing.

3.08 RECORD DRAWINGS:

A The Project record as-built drawings shall show the types and locations of installed:

1. Fiber Optic Cables.
2. Station Cables/Outlets.
3. Main Distribution Frames.
4. Intermediate Distribution Frames.
5. Patch panels.

B The Project record as-built drawings shall identify numbering on each cable identification label.

END OF SECTION

SECTION 27 41 16.06
ASSISTIVE LISTENING SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION OF WORK:

A Furnish and install all materials and equipment including all required equipment and connectors, and provide all labor required and necessary to complete the work shown on the drawings and/or specified in all Sections of Division 27 and all other work and miscellaneous items, not specifically mentioned, but reasonably inferred for a complete assistive listening system. It is the intent of the drawings and specifications that the system be complete, coordinated with the existing local sound system, and ready for operation.

B System shall include:

1. Portable, standalone assistive listening system

1.02 RELATED WORK:

A 27 05 00 General Requirements for Communications Systems

B Refer to the General Conditions, Supplementary General Conditions, and Division 1 General Requirements.

1.03 CODES AND STANDARDS:

A Devices and equipment for the local public address system shall be listed by U.L. for the specific purpose the device or equipment is used.

B Work and material shall be in compliance with and according to the requirements of the latest revision of the following standards and codes:

1. 2022 Building Standards Administrative Code, Part 1, Title 24 California Code of Regulations (C.C.R.)
2. 2022 California Building Code (CBC), Part 2, Title 24 C.C.R. - 2021 International Building Code and California Amendments
3. 2022 California Electric Code (CEC), Part 3, Title 24 C.C.R. - 2020 National Electric Code and California Amendments

1.04 SUBMITTALS:

A In accordance with Section 27 05 00.

B Submit the following items:

1. Manufacturer's Catalog Data: Manufacturer's original catalog cuts or original description of data of all material and equipment with sufficient information provided so that the exact function of each device is known.
2. Maintenance manuals and part lists. Manual shall include schematic drawings and service instructions. All parts shall be identified with standard part numbers and electrical characteristics, which can be recognized by Owner's maintenance technicians.

1.05 SUBSTITUTIONS:

A If substitutions are proposed, the Contractor shall show by “proof of performance" test that the substitute equipment is equal or superior to the equipment specifications, to the satisfaction of the Owner. This proof shall be shown by actual tests and not through printed literature. The Contractor shall provide qualified audio technicians and such test equipment as required to perform this test.

1. The cost of proof of performance tests shall be borne by the contractor and not included as part of the Contract.

1.06 WARRANTY:

A The transmitter and receiver shall have a 5 year warranty on parts and labor.

1.07 QUALIFICATIONS OF INSTALLER:

A Prior to installation, submit data for review showing that the contractor has at least 3 years experience successfully installed assistive listening systems of similar type and design, or that there is a contractual agreement with a subcontractor having related experience.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION:

A General: The system shall provide for portable, wireless, FM based local distribution of voice and music from the local sound system through the assistive listening system to wireless stereo receivers with headsets. The system shall be portable and of modular design to facilitate expansion and shall be completely solid state.

1. Work included in this Section: Complete wireless assistive listening system Including but not limited to the following:
   a. Digital Wireless Transmitter
   b. Wireless Stereo Receivers with Headsets
   c. Neck loop for telecoil-equipped hearing aid and coclear implant integration
   d. Charger and Carrying Case
   e. Test, operational check and demonstration of system operation

2.02 PORTABLE ASSITIVE LISTENING SYSTEM

A The Assistive Listening System shall consist of a single portable transceiver, over-head boom microphone, and personal receivers. Provide personal receivers with rechargeable batteries. Provide a purpose made carrying case and battery recharger. Provide neck loop lanyards.

B Transceiver:

1. Provide (1) Transceiver.
2. Transceiver shall have an “on” indicator, a power button, push button control for monitoring source audio or transmitted audio and an input overload indicator.
3. The transceiver shall be a digital transceiver operating on the 1.9 GHz unlicensed PCS band utilizing Frequency-Hopping Spread Spectrum (FHSS) techniques allowing interference free full duplex communication. The device shall employ a multiply layer security protocol consisting of a 40-bit (pin free) group subscription, 32-bit authentication and a 64-bit encryption scheme enabling secure conversations. It shall be easy to pair and form groups via Near-field communication (NFC), Docking Station or Software Suite. It shall be simple to operate with a Power, Talk and Volume Up and Down buttons. It shall allow up to 10 simultaneous groups to operate in the same area. It shall be powered via a removable non-proprietary rechargeable lithium-ion battery or via an optional 3 AAA alkaline battery compartment.
4. The transceiver shall have a 3.5 mm TRRS CTIA compliant headset connection allowing operation with a standard electret style headset. It shall have a built-in-microphone with auto detect circuitry if users elect to use their personal ear buds. It shall have a 64 x 128 OLED display with auto diming allowing display of all current status (group name, volume

levels, mute, battery status, time remaining, signal strength, unit ID, mode, etc.) The device shall have a leader clip and when inserted the unit automatically designates itself as a leader and allows the leader/presenter to control pairing/group creation and leader talkback modes (listen only, leader only or group).

5. The transceiver shall have a signal-to-noise ratio of 70 dB or greater and shall have an audio frequency response of 40 Hz – 15 kHz (±3 dB). The device shall incorporate automatic battery charging circuitry to charge and maintain the lithium-Ion battery either via the micro USB port or via the docking station using the additional charging contacts on the bottom of the device.
6. Manufacturer: Listen Technologies LK-1-A0 Portable ListenTalk Transceiver or approved equal. Provide with the following accessories from the same manufacturer:

C Wireless Stereo Receivers:

1. Provide fifteen (15) wireless stereo receivers.
2. The receiver shall be a digital receiver operating on the 1.9 GHz unlicensed PCS band utilizing Frequency-Hopping Spread Spectrum (FHSS) techniques allowing interference free one-way communication. The device shall employ a multiply layer security protocol consisting of a 40-bit (pin free) group subscription, 32-bit authentication and a 64-bit encryption scheme enabling secure conversations. It shall be easy to pair and form groups via Near-field communication (NFC), Docking Station or Software Suite. It shall be simple to operate with a Power and Volume Up and Down buttons. It shall allow up to 10 simultaneous groups to operate in the same area. It shall be powered via a removable non-proprietary rechargeable lithium-ion battery or via an optional 3 AAA alkaline battery compartment.
3. The receiver shall have a 3.5 mm TRRS CTIA compliant headphone connection allowing operation with a standard style headphones. It shall have a 64 x 128 OLED display with auto diming allowing display of all current status (group name, volume levels, battery status, time remaining, signal strength, unit ID, etc.)
4. The receiver shall have a signal-to-noise ratio of 70 dB or greater and shall have an audio frequency response of 40 Hz – 15 kHz (±3 dB). The device shall incorporate automatic battery charging circuitry to charge and maintain the lithium-Ion battery either via the micro USB port or via the docking station using the additional charging contacts on the bottom of the device.
5. Manufacturer: Listen Technologies LKR-11 ListenTalk Receiver Pro or approved equal. Provide with the following accessories from the same manufacturer:
   a. (15) LA-401 Universal Ear Speaker
   b. (3) LA-438 Intelligent Earphone/Neck Loop Lanyard

D Over-Head Headset with Boom Microphone:

1. Provide (1) Over-Head Headset with Boom Microphone.
2. Headset shall be over-head design with foam earpiece. Boom microphone extends forward in order to place the microphone closer to the user's mouth. Headset shall interface with transceiver with a 3.5mm audio jack.
3. Manufacturer: Listen Technologies LA-452 Headset 2 or approved equal.

E Charger and Carrying Case:

1. Provide (1) Charger and Carrying Case.
2. Manufacturer: Listen Technologies LA-481-01 Intelligent 16-Unit Charging Tray or approved equal.

2.03 WIRES AND CABLES:

A Provide all required interconnection cables and required connectors.

B All interconnection cables shall be professional type with very low impedance and gold contact connectors.

PART 3 EXECUTION

3.01 INSTALLATION AND WORKMANSHIP:

A All components shall be assembled, installed and tested by a Contractor specializing in communications systems.

B The Contractor shall take such precautions as are necessary to guard against electromagnetic and electrostatic hum and to install the equipment so as to provide maximum safety to the person who operates it.

C For portable equipment, furnish the equipment to the owner for safekeeping at a location on-site of their choosing.

3.02 TESTS:

A The Contractor shall perform an operational check to assure that the system complies with all requirements of these specifications. Operation tests shall be made in the presence of the Owner's representative, who shall be notified of the test date a minimum of ten (10) days prior to that date.

B The Contractor at no additional cost to the Owner shall replace any system, material or equipment found to be defective.

C Provide 1 hour of training to Owner to demonstrate system function.

END OF SECTION

SECTION 28 05 00
GENERAL REQUIREMENTS FOR SAFETY AND SECURITY

PART 1 GENERAL

1.01 DESCRIPTION OF WORK:

A The work of this Section consists of providing all required labor, supervision, materials and equipment (except equipment furnished by the Owner to be installed by the Contractor) to satisfactorily complete the work shown on the drawings and/or specified in all Sections of Division 28 and all other work and miscellaneous items, not specifically mentioned, but reasonably inferred for a complete and fully operating facility. The work shall include but not be limited to the following:

1. Furnish and install all required in-place equipment, conduits, conductors, cables and any miscellaneous materials for the satisfactory interconnection and operation of all associated electrical systems.

1.02 RELATED WORK:

A This Section provides the basic Electrical Requirements which supplement the General Requirements of Division 1 and apply to all Sections of Division 28.

1.03 STANDARDS AND CODES:

A All work and material shall be in compliance with and according to the requirements of the latest revision of the following standards and codes:

1. California Building Code (CBC)
2. California Electrical Code (CEC)
3. California Fire Code (CFC)
4. American National Standards Institute (ANSI) Publications:
   a. C2-02 National Electrical Safety Code
5. Code of Federal Regulations (CFR):
   a. 29 CFR 1910.147 Control of Hazardous Energy (Lock Out/Tag Out)
6. Electronics Industries Association (EIA)
7. Institute of Electrical and Electronics Engineers (IEEE)
8. National Electrical Testing Association (NETA):
   a. Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems, Standard ATS
9. National Electrical Manufacturers Association (NEMA)
10. Occupational Safety and Health Act (OSHA) Standards
11. State of California Public Utilities Commission:
    a. General Order 128 Rules for Construction of Underground Electric Supply and Communication Systems

B Variances: In instances where two or more codes are at variance, the most restrictive requirement shall apply.

C Underwriter Laboratories (UL) listing is required for all equipment and materials where such listing is offered by the Underwriters Laboratories. Safety labeling and listing by other organizations, such as ETL Testing Laboratories, may be substituted for UL labeling and listing if acceptable to the Owner. Provide service entrance labels for all equipment required by the NEC to have such labels.

1.04 SUBMITTALS:

A As specified in Division 1. Submit to the Engineer shop drawings, manufacturer's data and certificates for equipment, materials and finish, and pertinent details for each system specified. Obtain approval before procurement, fabrication, or delivery of the items to the job site. Partial submittals are not acceptable and will be returned without review.

B Submittals are required for all items, regardless of whether they are furnished as specified or are substituted.

C Information to be submitted includes manufacturer's name, trade name, equipment model number, nameplate data, equipment drawings including: size, layout dimensions and capacity, manufacturer's descriptive literature of cataloged products, diagrams, test data, and performance and characteristic curves as applicable. Furnish project specification and paragraph reference, applicable Federal, Industry and Technical Society Publication References, and years of satisfactory service of each item required to establish contract compliance. Photographs of existing installations and data submitted in lieu of catalog data are not acceptable and will be returned without approval.

D If submittal information includes multiple products, items being submitted for approval shall be clearly identified and Items not to be used on the project shall be clearly marked out.

E Organize submittals for equipment and items related to each specification section together as a package.

F Submit submittal packages in digital PDF format.

1. Certificates of Conformance: Submit manufacturer's certifications as required on products, materials, finish, and equipment indicated in the technical sections. Certifications shall be documents prepared specifically for this contract. Preprinted certifications and copies of previously submitted documents will not be acceptable. The manufacturer's certifications shall name the appropriate products, equipment, or materials and the publication specified as controlling the quality of that item. Certification shall not contain statements that imply the item does not meet requirements specified, such as "as good as", "achieve the same end use and results as materials formulated in accordance with the referenced publications;" or "equal or exceed the service and performance of the specified material." Certifications shall state that the item conforms to the requirements specified. Certificates shall be printed on the manufacturer's letterhead and shall be signed by the manufacturer's official, authorized to sign certificates of conformance.

G Substitutions:

1. The equipment included in the Contract Documents is used to establish standards of quality, utility, and appearance. Equipment which in the opinion of the Engineer is equal in quality, utility, and appearance will be approved as substitutions to that specified.
   a. Products that are specified by manufacturer, trade name or catalog number establish a standard of quality and do not prohibit the use of equal products of other manufacturers provided they are approved by the Engineer prior to bidding.
2. Substitutions will be accepted for review where there is a reasonable reason for the substitution. Reasonable reasons include:
   a. Cost savings to the owner. Include deductive change order with submittal.
   b. A product with features providing additional benefits to the end user.

c. Improved finished environment / Lay out of the final installation.
d. Delivery considerations.
e. Owner's specific requests.

3. Where items are noted as "or equal", a product of equal design, construction and performance will be considered.
4. Any item proposed as a substitute shall be accompanied by the following:
   a. Drawings and/or data giving sizes, capacities, all pertinent test data, catalog cut sheets, product information, and all other necessary information required to substantiate that the product is equal or exceeds that specified.
   b. A summary sheet noting each performance characteristic noted in the specification section or elsewhere in the contract documents of the specified product and the corresponding performance characteristics of the proposed substitution. The summary sheet shall contain the following information:
      1) Reason for Substitution Request
      2) Pertinent Performance Characteristics
      3) Specified Product Values
      4) Substituted Product Values
      5) Any substitution request that does not include the above information shall be rejected.
      6) Refer to the end of this specification section for an example form to be used for substituted products. A Microsoft Word version of the form can be provided to the Contractor for their use upon request.
5. Substitutions shall be equal, in the opinion of the Engineer, to the specified equipment. The burden of proof of such shall rest with the Contractor. When the Engineer in writing accepts a substitution, it is with the understanding that the Contractor guaranteed the substituted equipment to be equal to the one specified and dimensioned to fit within the construction. Approved substitutions shall not relieve the Contractor of responsibilities for the proper execution of the work, or from any provisions of the Plans or Specifications.
6. Contractor shall be responsible for coordination of the substituted products with other trades. Provide all additional connectivity, equipment, increased wire/conduit size, installation hardware, testing, and other miscellaneous appurtenances as required for a complete and fully functional installation.
7. Only one substitution will be considered for each product specified.
8. Alternate manufacturers must be submitted for approval 10 days prior to bid date unless noted otherwise in Division 1.
9. The Contractor shall be responsible for all expenses in connection with the substitution materials, process, and equipment, including the effect of his/her substitution on him/her, his/her sub-Contractor's or other Contractor's work. No substitution shall be permitted without written authorization of the Engineer. Any assumptions on the acceptability of a proposed substitution prior to acceptance by the Engineer are at the sole risk of the Contractor.

H Change Orders:

1. Where a change to the contract documents would result in a credit due to the Owner or a value add change to the project, provide a detailed change order request for the Engineer to review.
2. It shall be understood that the Engineer's review of costs associated with the change order shall not constitute approval of the change order or their associated costs. The Engineer's review shall be intended to assist the Owner in evaluating the costs associated with the change only. Final approval or rejection of the change order shall be at the discretion of the Owner.
3. Change order requests shall include the following information:
    1) Description of the change
    2) Reference to the document or written direction to make the change:
        (a) In the case of design-team directed changes, reference the drawing/sketch number or RFI number.
        (b) In the case of Owner-directed changes, reference the email, memo, or other written direction from the Owner and provide a copy of the direction.
    3) Detailed cost breakdown for the change:
        (a) Line item for each material noting:
            (1) Material used (e.g. ¾" EMT)
            (2) Total quantity (e.g. 200lf)
            (3) Unit cost (e.g. $2/lf)
            (4) Total materials cost (e.g. $400)
            (5) Unit labor hours (e.g 6hrs/100lf)
            (6) Total labor hours (e.g. 12hrs)
            (7) Hourly rate (e.g. $90/hr)
            (8) Total labor cost (e.g. $1,080
        (b) Total labor hours for each position (e.g. Journeyman vs. Superintendent)
        (c) Total materials cost
        (d) Overhead
        (e) Profit
        (f) Total change order value (positive for value added changes, negative for credits)

I Closeout Submittals:

1. As-built drawings: Submit As-Built Record documents as in accordance with section 3.05 below.
2. Cost analysis: Submit final cost information including original bid and any change orders broken down by system, material and labor costs (as applicable):
    a. Fire Alarm System
3. Operation and Maintenance Manuals: Furnish O & M Manuals for equipment where manuals are specified in the equipment specifications or are specified in Division 1. Electrical O & M Manuals shall include as a minimum:
    a. Copies of equipment supplied on the project.
    b. Instruction manuals including operation instructions and maintenance requirements/recommendations.

c. List of suppliers for all equipment with addresses and telephone numbers.
d. List of service support for all equipment with addresses and telephone numbers.
e. Copies of all test reports required in Division 28 specification sections.
f. Spare Parts: For each piece of equipment, submit a list of recommended spare parts. Include part numbers and the name, address, and telephone number of the supplier.
g. Other closeout documentation and test results as required under other sections of the specifications.
h. Provide in a single transmittal.
i. Warranty for all work, including contractor's general warranty.
j. All warranties begin as per the Contract, Division 1 or final acceptance of the Work by the Owner, Architect, Engineer, and Authority Having Jurisdiction, which ever is later:
    1) Manufacturer's Warrantees and Guarantees that are longer than the base contract/specified amount are to be provided with the manuals.
    2) The Contractor is responsible for all Warranty and Guarantee work whether or not the Manufacturer also Warrantees and Guarantees the product.

1.05 CONTRACT DOCUMENTS:

A Review the Drawings and Specification Divisions of other trades and perform the electrical work that will be required for the installations:
1. Should there be a need to deviate from the Electrical Drawings and Specifications, submit written details and reasons for all changes to the Engineer for favorable review.
2. All drawings and divisions of these specifications shall be considered as whole. This contractor shall report any apparent discrepancies prior to submitting bids.
3. Should there be a conflict or discrepancy between the drawings and specifications, or between different drawings sheets, or between different specification sections, the most expensive option shall be required, at the discretion of the Engineer.

B Drawings:
1. The Drawings shall govern the general layout of the completed construction.
    a. Locations of equipment, inserts, anchors, panels, pullboxes, manholes, conduits, stub-ups, fittings, devices, and ground connections are approximate unless dimensioned; verify locations with the Engineer prior to installation. Field verify scaled dimensions on Drawings.
    b. The general arrangement and location of existing conduits, piping, apparatus, etc., is shown as existing on drawings or specified. The drawings and specifications are for the assistance and guidance of the contractor, exact locations, distances and elevations are governed by actual field conditions. Extreme accuracy of data given herein and on the drawings is not guaranteed. Minor changes may be necessary to accommodate work. The contractor is responsible for verifying existing conditions. Should it be necessary to deviate from the design due to interference with existing conditions or work in progress, claims for additional compensation shall be limited to those for work required by unforeseen conditions as determined by the Engineer.

1.06 COORDINATION:

A Coordinate the electrical work with the other trades, code authorities, utilities and the Engineer:

1. Failure to accomplish this coordination is not a basis for additional cost reimbursement to the Contractor.
2. Coordinate does not mean to only send a Request For Information. Coordinate implies that the contractor is to take the lead in bringing all of the necessary organizations together to coordinate the work and to provide for the associated costs.

B Where connections must be made to existing installations, properly schedule all the required work, including the power and system shutdown periods. Schedule and carry out shutdowns so as to cause the least disruption to operation of the Owner's facilities:
1. Include costs for work during non-normal working hours and temporary facilities as may be required.
2. Include costs as necessary for sub-contractors to accomplish the specified work.

C When two trades join together in an area, make certain that no electrical work is omitted. Failure to accomplish this coordination is not a basis for additional cost reimbursement to the Contractor.

D Operations:
1. Perform all work in compliance with Division 1:
   a. Keep the number and duration of power and system shutdown periods to a minimum.
   b. All shutdowns which would interfere with the operations of Owner's equipment or facilities shall be coordinated with the Owner a minimum of 15 days in advance.
      1) Where Owner's equipment or facilities must remain operational during the shutdown, provide sufficient means to temporarily backup the interrupted services for the duration of the interruption.
   c. Show all proposed shutdowns and their expected duration on the construction schedule.
      1) If the construction schedule is created and maintained by others, make sure that the associated information is incorporated.
      2) Failure by the Contractor to properly schedule and plan for such activities is not a basis for additional compensation.
   d. Carry out shutdown only after the Engineer has favorably reviewed the schedule. Submit power/communications interruption schedule 15 days prior to date of interruption. Failure to provide schedule with adequate review time may result in rescheduling of the work at the Contractor's expense.

E Construction Power:
1. See Division 1 Temporary Utilities.

F Storage:
1. Provide adequate storage for all equipment and materials which will become part of the completed facility so that it is protected from sun, weather, condensation, dust, water, or construction operations.

G Damaged Products:
1. Notify the Engineer in writing in the event that any equipment or material is damaged. Obtain approval from the Engineer before making repairs to damaged products.

H Order material in such a timely manner and after approval of the same so as to insure that the approved material is available to be installed on site in a timely manner. Additional costs or substitutions necessitated because the Contractor failed to order material in a timely manner are not reimbursable. Costs associated with processing of paperwork by the owner and design

consultants resultant of such failures to coordinate the work by the Contractor shall have such costs reimbursed by the Contractor

1.07 LOCATIONS:

A General:

1. Use equipment, materials and wiring methods suitable for the types of locations in which they are located:
   a. Dry Locations:
      1) All those indoor areas which do not fall within the definition below for Wet Locations and which are not otherwise designated on the Drawings.
   b. Wet Locations:
      1) All locations exposed to the weather, whether under a roof or not, unless otherwise designated on the Drawings.

1.08 SAFETY AND INDEMNITY:

A The Contractor is solely and completely responsible for conditions of the job site including safety of all persons and properly during performance of the work. This requirement will apply continually and not be limited to normal working hours:

1. No act, service, drawing review or construction review by the Owner, the Engineer or their Consultants is intended to include reviews of the adequacy of the Contractors safety measures in or near the construction site.
2. The Contractor performing work under this Division of the Specifications shall hold harmless, indemnify, and defend the Owner, the Engineer, their consultants, and each of their officers, agents and employees from any and all liability claims, losses, or damage arising out of or alleged to arise from bodily injury, sickness, or death of a person or persons and for all damages arising out of injury to or destruction of property arising directly or indirectly out of or in connection with the performance of the work under this Division of the Specifications, and from the Contractor's negligence in the performance of the work described in the construction contract documents, but not including liability that may be due to the sole negligence of the Owner, the engineer, their Consultants or their officers, agents and employees.

PART 2 PRODUCTS

2.01 STANDARD OF QUALITY:

A Material and Equipment:

1. Provide materials and equipment that are new and are current products of manufacturers regularly engaged in the production of such products. The standard products shall have been in satisfactory commercial or industrial use for two years prior to bid opening. The two-year period includes use of equipment and materials of similar size under similar circumstances. For uniformity, only one manufacturer will be accepted for each type of product.

B Service Support:

1. Submit a certified list of qualified permanent service organizations including their addresses and qualification for support of the equipment. These service organizations shall be convenient to the equipment installation and able to render service to the equipment on a regular and emergency basis during the warranty period of the contract.

C Manufacturer's Recommendations:

1. Where installation procedures are required to be in accordance with manufacturer's recommendations, furnish printed copies of the recommendations prior to installation. Installation of the item shall not proceed until recommendations are received. Failure to furnish recommendation shall be cause for rejection of the equipment or material.

2.02 NAMEPLATES:

A For each piece of electrical equipment, provide a manufacturer's nameplate showing his name, location, the pertinent ratings, the model designation, and shop order number.

B Additionally, identify each piece of equipment and related controls with a rigid laminated engraved plastic nameplate. Unless otherwise noted, nameplates shall be melamine plastic 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be 1 by 2.5 inches unless otherwise noted. Where not otherwise specified, lettering shall be a minimum of 0.25 inch high normal block style. Engrave nameplates with the inscriptions indicated on the Drawings and, if not so indicated, with the equipment name. Securely fasten nameplates in place using two stainless steel screws or, where favorably reviewed by the Engineer, with epoxy cement. Where no inscriptions are indicated on the Drawings, furnish nameplates with appropriate inscriptions furnished by the Engineer upon prior request by the Contractor.

2.03 FASTENERS:

A Fasteners for securing equipment to walls, floors and the like shall be either hot-dip galvanized after fabrication or stainless steel.

2.04 FINISH REQUIREMENTS:

A Equipment:

1. Refer to each electrical equipment section of these Specifications for painting requirements of equipment enclosures. Repair any final paint finish which as been damaged or is otherwise unsatisfactory, to the satisfaction of the Engineer.

B In finished areas, paint all exposed conduits, boxes and fittings to match the color of the surface to which they are affixed.

C Conduits for fire alarm or life safety raceways shall be factory painted red along their entire length.

PART 3 EXECUTION

3.01 INSTALLATION:

A Ensure that all equipment and materials fit properly in their installation.

B Perform any required work to correct improperly fit installation at no additional expense to the owner.

C Equipment Installation:

1. Provide the required inserts, bolts and anchors, and securely attach all equipment and materials to their supports.
2. Mount all metal panels which are mounted on or abutting concrete walls or any outside walls a minimum of ¼ inch from the wall, and paint the back sides of the panels with Bituminous Coating, Rust-oleum C9578 Coal Tar Epoxy Coating or approved equal. Film thickness shall be 10 mils minimum.

D Cutting, Drilling and Welding:

1. Provide the required cutting, drilling welding that is required for the electrical construction work. Comply with Division 1 requirements.
2. Structural members shall not be cut or drilled, except after approval by the Engineer. Use a core drill wherever it is necessary to drill through concrete or masonry.
3. Provide the required welding for equipment supports. Conduits and fittings shall not be welded to structural steel. Where welding is required, it shall be accomplished by tradesmen certified to do such work. Provide fire and other protection as appropriate.

3.02 FIELD TESTS:

A Test shall be in accordance with Acceptance Testing specifications issued by the National Fire Protection Association (NFPA) 72 Chapter 7 for fire alarm and manufacturer's recommendations for security systems.

B Perform equipment field tests and adjustments. Properly calibrate, adjust and operationally check all devices and components, and demonstrate as ready for service. Make additional calibration and adjustments if it is determined later that the initial adjustments are not satisfactory for proper performance. Perform equipment field test for equipment where equipment field tests are specified in the equipment Specifications. Give sufficient notice to the Engineer prior to any test so that the tests may witnessed.

C Provide instruments, supplies, other equipment, temporary facilities as may be necessary and material required for the tests. Instruments shall be of the type designed for the type of tests to be performed and shall be calibrated by a recognized testing laboratory within three months prior to testing.

D Operational Tests: Operationally test all circuits to demonstrate that the circuits and equipment have been properly installed and adjusted and are ready for full-time service. Demonstrate the proper functioning of circuits in all modes of operation, including alarm conditions.

E Re-testing will be required for all unsatisfactory tests after the equipment or system has been repaired. Re-test all related equipment and systems if required by the Engineer. Repair and re-test equipment and systems which have been satisfactorily tested but later fail, until satisfactory performance is obtained.

F Perform calibration and adjustment on all equipment.

G Maintain records of each test and submit five copies to the Engineer when testing is complete. All tests shall be witnessed by the Engineer. These records shall include:

1. Name of equipment tested.
2. Date of report.
3. Date of test.
4. Description of test setup.
5. Identification and rating of test equipment.
6. Test results and data.
7. Name of person performing test.
8. Owner or Engineer's initials.

H Items requiring testing as a minimum:

1. Fire Alarm System.

3.03 PAINTING OF EQUIPMENT:

A Factory Applied:

1. Electrical equipment shall have factory applied painting system which shall, as a minimum, meet the requirements of NEMA ICS 6 corrosion-resistance test and the additional requirements specified in the technical section. Fire alarm raceways shall be factory painted red.

B Field Applied:

1. Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria.

3.04 SIGNAGE:

A Nameplate Mounting:

1. Provide number, location and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two stainless steel sheet-metal screws or two rivets.

3.05 RECORDS:

A Maintain one copy of the contract Drawing Sheets on the site of the work for recording the record "as built" condition. After completion of the work, the Contractor shall neatly and carefully mark the work as actually constructed, revising, deleting and adding to the Drawing Sheets as required. The following requirements shall be complied with:

1. Drawings and associated as-built changes shall be completed in AutoCAD or Revit and submitted in CAD/Revit as well as PDF format. Documents with hand-written changes or with RFI responses and field sketches pasted on shall not be acceptable. Engineer shall make digital backgrounds of original contract documents available for Contractor's use upon request.
2. Cable Size and Type: Provide the size and type of each cable installed on the project.
3. Substructure: Where the location of duct lines, adjacent utilities, cable boxes, and manholes are found to different than shown, carefully mark the correct location on the Drawings. Work shall be dimensioned from existing improvements.
4. Record (As Built) Drawings: At the completion of the Work the Contractor shall provide a set of record "as built" drawings over to the Owner for his use:
   a. Record drawings are required to be transmitted within 30 days of beneficial occupancy.
   b. Transmittal and approval process:
      1) Contractor is to transmit one printed copy for review and comment.
      2) After acceptance of the above, the Contractor is to transmit three printed sets and one digital reproducible set.
      3) Contractor to provide information on their company in the margin of record drawings along with the date of the revisions and the associated revision number.

3.06 POSTED OPERATING INSTRUCTIONS:

A Provide for each system and principal item of equipment as specified in the technical sections for use by operation and maintenance personnel. The operating instructions shall include the following:

1. Single line diagrams, wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
2. Start up, proper adjustments, operating, lubrication and shutdown procedures.
3. Safety precautions.

4. The procedure in the event of equipment failure, trouble or alarm.
5. Other items of instruction as recommended by the manufacturer of each system or item of equipment.

3.07 INSTRUCTION TO OWNER'S PERSONNEL:

A Where specified in the technical sections, furnish the services of competent instructors to give full instruction to designated personnel in the adjustment, operation and maintenance of the specified systems and equipment, including pertinent safety requirements as required. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or systems has been accepted and turned over to the Owner for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the individual section. When more than 4 man-days of instruction are specified, use approximately half of the time for classroom instruction. Use other time for field instruction with equipment or system. When significant changes or modifications in the equipment or system are made under the terms of the contract, provide additional instructions to acquaint the operating personnel with the changes or modifications.

B Contractor shall video record all training sessions and shall provide the Owner with a copy of the recording at the conclusion of the training. Recording shall be in digital video format (MP4, AVI, or similar) and shall be provided on USB stick or DVD labeled with the Contractor’s contact information, the training topic, and date of training.

C Contractor shall maintain an attendance sheet from each session which contains the following information:

1. Attendees with associated arrival and departure time.
2. Topics covered.
3. Information provided.
4. Signatures of attendees taken at the completion of the session.

3.08 CLEAN UP:

A Thoroughly clean all soiled surfaces of installed equipment and materials.

B Upon completion of electrical work, remove all surplus materials, rubbish, and debris that accumulated during the construction work. Leave the entire area neat, clean, and acceptable to the Engineer.

END OF SECTION

SECTION 28 05 13
WIRE AND CABLES FOR SAFETY AND SECURITY

PART 1 GENERAL

1.01 DESCRIPTION OF WORK:

A The work of this Section consists of providing all wire and cable rated 600 volts or less, including splices and terminations, as shown on the Drawings and as described herein.

1.02 RELATED WORK:

A See the following Specification Section for work related to the work in this Section:
1. 28 05 00 General Requirements for Safety and Security Systems
2. 26 05 33.13 Conduit for Electrical Systems
3. 26 05 33.16 Boxes for Electrical Systems

1.03 STANDARDS AND CODES:

A Work and materials shall be in compliance with and according to the requirements of the latest revision of the following Standards and Codes:
1. American Society for Testing and Materials (ASTM):
   a. B3-01, Specification for Soft or Annealed Copper Wire
   b. B8-99, Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard or Soft
   c. B173-01a, Specification for Rope-Lay-Stranded Copper Conductors Having Concentric-Stranded Members, for Electrical Conductors
2. Federal Standards (FED. STD.):
   a. 228, Methods of Testing Insulated Cable and Wire
3. Federal Specifications (FS):
   a. A-A-59544, Cable and Wire, Electrical
   b. A-A-55809, Pressure Sensitive Electrical Plastic Insulation Tape
4. National Electrical Manufacturers Association (NEMA):
   a. WC 70-1999/ICEA S-95-658-1999, Cross-Linked Thermosetting Polyethylene, Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
5. California Electrical Code (CEC)
6. National Electrical Code (NEC)
7. Underwriters Laboratories (UL):
   a. 44-83 (R1988), Rubber-Insulated Wires and Cable
   b. 83-1983 (R1989), Thermoplastic-Insulated Wires and Cables
   c. 510-1986, Insulating Tape

1.04 SUBMITTALS:

A As specified in Division 1 and Section 28 05 00.
1. Catalog Data: Provide manufacturer's descriptive literature.
2. Single Submittal: A single complete submittal is required for all products covered by this Section.

PART 2 PRODUCTS

2.01 CONDUCTORS:

A General:

1. Conductors shall be copper, Class B stranded and of the sizes indicated. All conductors 120 volts and above shall be in raceway unless otherwise noted. Minimum power and control wire size shall be No. 12 AWG unless otherwise specified by the Owner's Representative. All cable used on this Project shall be of the same type and conductor material.

B Unless otherwise noted, conductors #6 and larger shall be XHHW insulation suitable for operation in wet or dry locations at temperatures not to exceed 75C in wet locations and 90C in dry locations. Conductors #8 and smaller shall be THHN in dry locations and THWN/THHN in wet locations. Control Cable shall be THHN.

C Insulation Marking:

1. All insulated conductors shall be identified with printing colored to contrast with the insulation color.

D Special Wiring:

1. Where special wiring is proposed by an equipment manufacturer, submit the special wiring requirements to the Owner's Representative and, if approved, provide same. Special wire shall be the type required by the equipment manufacturer.

E Other Wiring:

1. Wire or cable not specifically shown on the Drawings or specified, but required, shall be of the type and size required for the application and as approved by the Owner's Representative.

F Terminations:

1. Cable Termination for Copper: Crimp style two hole NEMA spade terminals designed and rated for copper cable.
2. Wire Terminations: Crimp on ring-tongue terminals, insulated sleeve, of proper size for the wire used.
3. End Seals: Heat shrink plastic caps of proper size for the wire on which used.
4. Manufacturer: T&B, Burndy or approved equal.

G Manufacturer: General Cable Inc., Southwire, or approved equal.

2.02 FIRE ALARM CABLES:

A Addressable Loop Cables:

1. Verify recommended cable type with system manufacturer. Cable shall be minimum #14 shielded twisted pair, unless otherwise noted. Refer to drawings and 28 31 00 Fire Alarm system for additional requirements:
   a. Cable for all exterior, underground or wet locations shall be outdoor rated with water-blocked construction, sunlight and moisture resistance jacket.
      1) Manufacturer: #14ga - WestPenn AQ295 or approved equal
   b. Cable for all interior areas shall be plenum rated cable.
      1) Manufacturer: #14ga - WestPenn 60992BS or approved equal

B Notification Circuit Cables:

1. Refer to section 2.01 Conductors for Notification Circuit Cables. Refer to drawings for size and quantity. Refer to Specification Section 28 31 00 - Fire Alarm System for additional requirements.

2.03 TAPE:

A Tape used for cable marking shall be compatible with the insulation and jacket of the cable and shall be of plastic material. Tape shall conform to FS HH-I-595 and UL 510.

PART 3 EXECUTION

3.01 CABLE INSTALLATION:

A Clean Raceways:

1. Clean all raceways prior to installation of cables as specified in Specification Section 28 05 00 – Safety/Security System Raceways and Fittings.

B Cable Pulling:

1. Exercise care in pulling wires and cables into conduit or wireways so as to avoid kinking, putting undue stress on the cables or otherwise abrading them. No grease will be permitted in pulling cables. Only soapstone, talc, or UL listed pulling compound will be permitted. The raceway construction shall be complete and protected from the weather before cable is pulled into it. Swab conduits before installing cables and exercise care in pulling, to avoid damage to conductors.

C Bending Radius:

1. Cable bending radius shall be per applicable code. Install feeder cables in one continuous length.

D Equipment Grounding Conductors:

1. Provide an equipment grounding conductor, whether or not it is shown on the Drawings, in any conduit or any raceway.

E Wiring at Hinges:

1. For cables crossing hinges, utilize extra flexible stranded wire, make up into groups not exceeding 12, and arrange so that they will be protected from chafing when the hinged member is moved.

F All wiring and cable shall be supported from the structure above. All wiring below 100 volts shall be installed in conduit unless otherwise noted.

G Low Voltage Cables:

1. All cables provided inside buildings shall be plenum rated.
2. All cables provide outside buildings shall be outdoor rated, gel filled cables.
3. All low voltage wires and cables concealed in walls shall be run in EMT conduit from flush outlet boxes to above accessible ceilings. Provide conduit where cables penetrate floors and fire walls above ceilings. Where low voltage cables run parallel to line voltage (over 120 volts), they shall be installed a minimum of 12 inches apart.

3.02 CABLE TERMINATIONS AND SPLICES:

A Splices:

1. All fire alarm and security cables shall be continuous below grade (i.e. no splices or terminations below grade).
2. Use UL listed wirenuts for line voltage branch circuits in dry locations.

B Terminations: Shall comply with the following:

1. Make up and form cable and orient terminals to minimize cable strain and stress on device being terminated on.
2. Burnish oxide from conductor prior to inserting in oxide breaking compound filled terminal.

3.03 FIELD TESTS:

A The Contractor shall perform the following tests at his expense:

1. Continuity Test of Wire:
   a. Test each wire for continuity and accuracy of the identifying tags at both ends and at all locations marked. Submit a report to the Owner's Representative certifying the fact of the test and the accuracy of the marking.
2. Insulation Resistance Tests:
   a. Perform insulation resistance tests on all wire and cable installed. Make these tests after all equipment has been connected, except that equipment which may be damaged by the test voltage shall be disconnected. Test the insulation with a 500 Vdc insulation resistance tester with a scale reading not less than 100 megohms. The insulation resistance shall be 2 megohms or more. Submit results for review.

END OF SECTION

SECTION 28 46 00
INTELLIGENT COMMUNICATING FIRE DETECTION SYSTEM

PART 1.0 - GENERAL

1.01 DESCRIPTION:

A This section of the specification includes the furnishing, installation, connection and testing of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete, operative, coordinated system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, Fire Alarm Control Panel (FACP), auxiliary control devices, annunciators, and wiring as shown on the drawings and specified herein.

B The fire alarm system shall comply with requirements of NFPA Standard No. 72 for Local Protected Premises Signaling Systems except as modified and supplemented by this specification. The system field wiring shall be supervised either electrically or by software-directed polling of field devices.

1. The Secondary Power Source of the fire alarm control panel can provide at least 24 hours of backup power with the ability to sustain 5 minutes in alarm at the end of the backup period.

C The fire alarm system shall be manufactured by an ISO 9001 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994.

D The FACP and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof).

1. Underwriters Laboratories Inc. (UL) - USA:
2. UL 38 Manually Actuated Signaling Boxes
3. UL 217 Smoke Detectors, Single and Multiple Station
4. UL 228 Door Closers–Holders for Fire Protective Signaling Systems UL 268 Smoke Detectors for Fire Protective Signaling Systems
5. UL 268A Smoke Detectors for Duct Applications
6. UL 346 Waterflow Indicators for Fire Protective Signaling Systems UL 464 Audible Signaling Appliances
7. UL 521 Heat Detectors for Fire Protective Signaling Systems
8. UL 864 Standard for Control Units for Fire Protective Signaling Systems UL 1481 Power Supplies for Fire Protective Signaling Systems
9. UL 1610 Central Station Burglar Alarm Units
10. UL 2075 Standard for Gas and Vapor Detectors and Sensors
11. UL 1638 Visual Signaling Appliances
12. UL 1971 Signaling Devices for Hearing Impaired
13. UL 2017 General-Purpose Signaling Devices and System
14. 1. The FACP shall be ANSI 864, 10th Edition Listed. Systems listed to ANSI 864, 8th edition (or previous revisions) shall not be accepted.
    a. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final check-out and to ensure the systems integrity.

1.02 SCOPE:

A An intelligent, microprocessor-controlled, fire alarm detection system shall be installed in accordance to the project specifications and drawings.

B Basic Performance:

1. Initiation Device Circuits (IDC) shall be wired NFPA Style B (Class B) as part of an addressable device connected by the SLC Circuit.
2. When not wired directly from panel NAC circuits, Notification Appliance Circuits (NAC) shall be wired NFPA Style Y (Class B) as part of an addressable device connected by the SLC Circuit.
3. All circuits shall be power-limited, per UL864 requirements.
   a. A single ground fault or open circuit on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
4. Alarm signals arriving at the main FACP shall not be lost following a primary power failure or outage of any kind until the alarm signal is processed and recorded.
5. Panel shall meet requirements of UL-864 10th Edition

C BASIC SYSTEM FUNCTIONAL OPERATION

1. When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:
2. The system Alarm LED on the FACP shall flash.
3. A local sounder with the control panel shall sound.
4. A backlit 80-character LCD display on the FACP shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
5. In response to a fire alarm condition, the system will process all control programming and activate all system outputs (alarm notification appliances and/or relays) associated with the point(s) in alarm
6. In response to a fire alarm condition, the system will process all control programming and activate all system outputs (alarm notification appliances and/or relays) associated with the point(s) in alarm. Additionally, the system shall send
   a. events to a central alarm supervising station via either dial-up over PSTN, IP, Cellular, Internet, Intranet via PSDN or virtual private network.

1.03 SUBMITTALS

A General:

1. Two copies of all submittals shall be submitted to the Architect/Engineer for review.
2. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality. Equivalent compatible UL-listed equipment from other manufacturers may be substituted for the specified equipment, if the minimum standards are met.
3. For equipment, other than that specified, the contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment.

B Shop Drawings:

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
2. Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.
3. Show annunciator layout, configurations, and terminations.

C Manuals:

1. Submit simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets.
2. Wiring diagrams shall indicate internal wiring for each device and the interconnections between the items of equipment.
3. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.

D Software Modifications

1. Provide the services of a qualified technician to perform all system software modifications, upgrades or changes. Response time of the technician to the site shall not exceed 4 hours.
2. Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.
3. Provide firmware updates through USB thumb drive.

1.04 GUARANTY:

A All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one-year period, shall be included in the submittal bid.

1.05 MAINTENANCE:

A Maintenance and testing shall be on a semi-annual schedule or as required by the local AHJ. A preventive maintenance schedule shall be provided by the contractor describing the protocol for preventive maintenance. The schedule shall include:

1. Systematic examination, adjustment and cleaning of all detectors, manual fire alarm stations, control panels, power supplies, relays, waterflow switches and all accessories of the fire alarm system.
2. Each circuit in the fire alarm system shall be tested semiannually.
3. Each smoke detector shall be tested in accordance with the requirements of NFPA 72 Chapter 10.

B As part of the bid/proposal, include a quote for a maintenance contract to provide all maintenance, tests, and repairs described below. Include also a quote for unscheduled maintenance/repairs, including hourly rates for technicians trained on this equipment, and response travel costs for each year of the maintenance period. Submittals that do not identify all post contract maintenance costs will not be accepted. Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.

1.06 POST CONTRACT EXPANSIONS:

A The contractor shall have the ability to provide parts and labor to expand the system specified, if so requested, for a period of five (5) years from the date of acceptance.

B As part of the submittal, include a quotation for all parts and material, and all installation and test labor as needed to increase the number of intelligent or addressable devices by ten percent (10%). This quotation shall include intelligent smoke detectors, CO detectors intelligent heat detectors, addressable manual stations, addressable beam detectors, addressable monitor modules and addressable control modules equal in number to one tenth of the number required to meet this specification (list actual quantity of each type).

C The quotation shall include installation, test labor, and labor to reprogram the system for this 10% expansion. If additional FACP hardware is required, include the material and labor necessary to install this hardware.

D Do not include cost of conduit or wire or the cost to install conduit or wire except for labor to make final connections at the FACP and at each intelligent addressable device. Do not include the cost of conventional peripherals or the cost of initiating devices or notification appliances connected to the addressable monitor/control modules.

E Submittals that do not include this estimate of post contract expansion cost will not be accepted.

1.07 APPLICABLE STANDARDS AND SPECIFICATIONS:

A The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards, if applicable.

B National Fire Protection Association (NFPA) - USA: No. 13 Sprinkler Systems

1. No. 70 National Electric Code (NEC) No. 72 National Fire Alarm Code No. 101 Life Safety Code

C The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.

D Local and State Building Codes.

E All requirements of the Authority Having Jurisdiction (AHJ).

1.08 APPROVALS:

A The system shall have proper listing and/or approval from the following nationally recognized agencies:

1. ETL Electrical Testing Laboratories (ES-50XP & ES-200XP models only) UL Underwriters Laboratories Inc (10th Edition)
   a. FM Factory Mutual
   b. MEA Material Equipment Acceptance (NYC) CSFM California State Fire Marshal
      1) CAN/ULC - S527-99 Standard for Control Units for Fire Alarm Systems PART 2.0 PRODUCTS

PART 2.0 - EQUIPMENT

2.01 EQUIPMENT AND MATERIAL, GENERAL:

A All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment, and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a fire protective signaling system, meeting the National Fire Alarm Code.

B All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.

C All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

D All equipment must be available "over the counter" through the Security Equipment Distributor (SED) market and can be installed by dealerships independent of the manufacturer.

2.02 CONDUIT AND WIRE:

A Conduit:

1. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements.
2. Where required, all wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
3. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per NEC Article 760-29.
4. Apart from telephone connections, wiring for 24-volt DC control, alarm
   a. notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
5. Conduit shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or backboxes, except where conduit entry is specified by the FACP manufacturer.
6. Conduit shall be 3/4-inch (19.1 mm) minimum.

B Wire:

1. All fire alarm system wiring shall be new.
2. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and 14 AWG (1.63 mm) for Notification Appliance Circuits.
3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
4. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NEC 760 (e.g., FPLR).
5. Wiring used for the multiplex communication circuit (SLC) shall be twisted non-shielded and support a minimum wiring distance of 10,000 feet when sized at 12 AWG.
6. All field wiring shall be electrically supervised for open circuit and ground fault.

7. The fire alarm control panel shall be capable of T-tapping NFPA Style 4 (Class B) Signaling Line Circuits (SLCs). Systems which do not allow or have restrictions for the number of T-taps, length of T-taps etc., are not acceptable.

C Terminal Boxes, Junction Boxes and Cabinets:

1. All boxes and cabinets shall be UL listed for their use and purpose.

D The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold water pipe or grounding rod. The control panel enclosure shall feature a quick removal chassis to facilitate rapid replacement of the FACP electronics.

1. The FACP shall be capable of coding Notification Appliance Circuits in March Time Code (120 PPM), Temporal (NFPA 72 A-2-2.2.2), and California Code. Main panel notification circuits (NACs 1 & 2) shall also automatically synchronize any of the following manufacturer's notification appliances connected to them: System Sensor, Wheelock, and Gentex, with no need for additional synchronization modules.

2.03 MAIN FIRE ALARM CONTROL PANEL:

A The FACP shall be a Fire-Lite Model ES-1000X and shall contain a microprocessor- based Central Processing Unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, Digital Dialer and Ethernet Communicators and other system-controlled devices. Ethernet communications shall be via a IPOTs card

B Operator Control

1. Acknowledge Switch:
   a. Activation of the control panel Acknowledge switch in response to new alarms and/or troubles shall silence the local panel piezo electric signal and change the alarm and trouble LEDs from flashing mode to steady-ON mode. If multiple alarm or trouble conditions exist, depression of this switch shall advance the 80-character LCD display to the next alarm or trouble condition.
   b. Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.
2. Alarm Silence Switch:
   a. Activation of the alarm silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition after an alarm condition. The selection of notification circuits and relays that are silence able by this switch shall be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto-silence timers.
3. Alarm Activate (Drill) Switch:
   a. The Alarm Activate switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced or reset.
4. System Reset Switch:

a. Activation of the System Reset switch shall cause all electronically latched initiating devices, appliances, or software zones, as well as all associated output devices and circuits, to return to their normal condition.

5. Lamp Test:
   a. The System RESET switch shall also function as a Lamp Test switch and shall activate all system LEDs and light each segment of the liquid crystal display.
6. Programmable Buttons:
   a. The system should have at a minimum 4 programmable function keys for quick zone and NAC disable during maintenance.

C System Capacity and General Operation

1. The control panel shall provide, or be capable of, expansion to 50 intelligent/addressable devices of any type, detector, or module
2. The control panel shall include two Form-C programmable relays, which can be used for Alarm, and Supervisory and a fixed Trouble relay rated at a minimum of 2.5 amps @ 30 VDC. It shall also include 2 programmable Notification Appliance Circuits (NACs) capable of being wired as NFPA Style Y (Class B) or NFPA Style Z (Class A). Either programmable Notification circuit shall also provide auxiliary power when programmed as such.
3. The fire alarm control panel shall include an operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display (LCD), individual color-coded system status LEDs, and an alphanumeric keypad for the field programming and control of the fire alarm system.
4. All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the fire alarm control panel. The system shall be fully programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate programming changes. The control unit will support the ability to upgrade its operating program using FLASH memory technology. The unit shall provide the user with the ability to program from either the included keypad or a USB drive programmed from FS- Tools.
5. The system shall allow the programming of any input to activate any output or group of
   a. outputs. Systems which have limited programming (such as general alarm), have complicated programming (such as a diode matrix), or REQUIRE a laptop personal computer is not considered suitable substitutes.
6. The FACP shall provide the following features:
   a. Drift compensation to extend detector accuracy over life. Drift compensation shall also include a smoothing feature, allowing transient noise signals to be filtered out.
   b. Detector sensitivity test, meeting requirements of NFPA 72, Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.
   c. The ability to display or print system reports.
   d. Alarm verification, with counters and a trouble indication to alert maintenance personnel when a detector enters verification an excessive number of times.
   e. Positive Alarm Sequence (PAS presignal), meeting NFPA 72 requirements.

f. Rapid manual station reporting.
g. Non-alarm points for general (non-fire) control.
h. Periodic detector test, conducted automatically by the software.
i. Walk test, with a check for two detectors set to same address.
j. Universal end of line resistor for NACs and remote sync output
k. Temporal-4 NAC coding for CO alarms.
l. Built in Class-A capability for all 4 NACs
m. Local upload/download using USB drive.
n. Flash firmware with USB thumb drive.

7. The FACP shall be capable of coding Notification Appliance Circuits in March Time Code (120 PPM), Temporal (NFPA 72) for fire alarm and CO alarm, and California Code. Main panel notification circuits (NACs 1 & 2) shall also automatically synchronize and be programmable for any of the following manufacturer's notification appliances connected to them: System Sensor, Wheelock, Gentex, with no need for additional synchronization modules

D Display

1. The display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters.
2. The display shall include status information and custom alphanumeric labels for all intelligent detectors, addressable modules, internal panel circuits, and software zones.
3. The display shall contain an alphanumeric, text-type display and dedicated LEDs for the annunciation of AC POWER, FIRE ALARM, SUPERVISORY, TROUBLE and ALARM SILENCED, CO Alarm conditions.
4. The display keypad shall be part of the standard system and have the capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels shall be provided to prevent unauthorized system control or programming.
5. The display shall include the following operator control switches: ACKNOWLEDGE/STEP, ALARM SILENCE, DRILL (alarm activate), and SYSTEM RESET.

E Signaling Line Circuit (SLC)

1. The FACP's SLC interface shall provide power to and communicate of any type including: intelligent detectors (ionization, photoelectric, CO or thermal) addressable pull stations, addressable Beam Detectors, intelligent modules (monitor or control). Each SLC shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring.
2. The CPU shall receive information from all intelligent detectors to be processed to determine whether normal, alarm, pre-alarm, or trouble conditions exist for each detector. The software shall automatically compensate for the accumulation of dust in each detector up to allowable limits. The information shall also be used for automatic detector testing and for the determination of detector maintenance conditions.
3. The detector software shall meet NFPA 72, Chapter 10 requirements and be certified by UL as a calibrated sensitivity test instrument.

F Serial Interfaces

1. An annunciator RS-485 bus shall be used to connect an UL-Listed 80-column printer anywhere within the 6,000 range of the serial bus connection. The printer shall communicate with the control panel using an RS-485 converter/interface complying with Electrical Industries Association standard EIA-232D. Power to the printer shall be 120 VAC @ 60 Hz. The interface shall contain both a 9-pin serial and standard centronics parallel connector. Either shall be capable of connection to a serial or parallel printer. The bus shall also provide connection to additional addressable modules supporting remote 80 character LCD text annunciators that mimic the standard
   a. panel display and controls. Said annunciators shall support remote acknowledge, silence, drill and reset functions and shall be enabled via a keyswitch. The bus shall also provide connection to addressable modules supporting up to 40 LEDs for use with a graphic annunciator.

G The control panel will have the capability of Reverse Polarity Transmission or connection to a Municipal Box for compliance with applicable NFPA standards.

H The ES-50X, ES-200X, ES-1000X shall contain an Internet Protocol Over Telephone Service (IPOTS) is an interface for communicating digital information between a fire alarm control panel and a UL- Listed central station. The IPOTs module is capable of transmitting contact ID formatted alarms to a central station equipped with a compatible IP receiver via Ethernet over a private or public WAN/LAN, Intranet or Ethernet.

1. The IPOTS communicator shall be an integral module component of the fire alarm control panel enclosure.
2. The IPOTS communicator shall be completely field-programmable locally from a USB port or via Ethernet, Telnet and through AlarmNet.
3. The IPOTS communicator shall be capable of transmitting events in contact ID format.
4. Communication shall include vital system status such as:
   a. Independent Zone (Alarm, trouble, non-alarm, supervisory)
   b. Independent Addressable Device Status
   c. AC (Mains) Power Loss
   d. Low Battery and Earth Fault
   e. System Off Normal
   f. 12- and 24-Hour Test Signal
   g. Abnormal Test Signal (per UL requirements)
   h. EIA-485 Communications Failure
   i. IP Line Failure
5. The IPOTS communicator shall support independent zone/point reporting. In this format, the IPOTS shall support the transmission of addressable points within the system. This format shall enable the central station to have exact details concerning the location of the fire for emergency response. The communication over IP / cellular shall be transparent to the panel’s normal operation over phone lines.
6. The IPOTS communicator shall utilize a supervisory heartbeat signal of no less than once every 90 seconds insuring multiplexed level line supervision.
   a. Loss of Internet or Intranet connectivity shall be reported in no more than 200 seconds. This IPOTS communicator can also program communication in supervisor according

to all NFPA guidelines. Alarm events shall be transmitted to a central station within 90 seconds from time of initiation to time of notification.

I Enclosures:

1. The control panel shall be housed in a UL-listed cabinet suitable for surface or semi- flush mounting. The cabinet and front shall be corrosion protected and painted red via the powder coat method with manufacturer's standard finish.
2. The back box and door shall be constructed of steel with provisions for electrical conduit connections into the sides and top.
3. The door shall provide a key lock and shall provide for the viewing of all indicators.
4. The cabinet shall accept a chassis containing the PCB and to assist in quick replacement of all the electronics including power supply shall require no more than two bolts to secure the panel to the enclosure back box.
5. The cabinet shall also support a mechanical secured optional dress panel limiting access to the internals of the panel.

J Field Charging Power Supply:

1. The FCPS is a device designed for use as either a remote 24-volt power supply or as a booster for powering Notification Appliances.
2. The FCPS shall offer up to 8.0 amps (6.0 amps continuous) of regulated 24 volt power. It shall include an integral charger designed to charge 18.0 amp hour batteries.
3. The Field Charging Power Supply shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the fire alarm control panel) or a control relay. Four NAC outputs, wired NFPA Style Y or Z, shall be available for connection to the Notification devices.
4. The FCPS shall optionally provide synchronization of all connected strobes or horn strobe combinations when System Sensor, Wheelock or Gentex devices are installed.
   a. The FCPS shall function as a sync follower as well as a sync generator.
5. The FCPS shall include a surface mount backbox.
6. The Field Charging Power Supply shall include the ability to delay the reporting of an AC fail condition per NFPA requirements.
   a. The FCPS shall provide 24 VDC regulated and power-limited circuitry per UL standards. Should this be updated to latest UL standard?

K Power Supply:

1. The main power supply for the fire alarm control panel shall provide up to 3.0 amps For ES-50X or ES-50XP, up to 6.0 amps for ES-200X or ES-200XP and up to 8.0 amps for ES-1000X available power for the control panel and peripheral devices.
2. Provisions will be made to allow the audio-visual power to be increased as required by adding modular expansion audio-visual power supplies.
3. Positive-Temperature-Coefficient (PTC) thermistors, circuit breakers, or other over- current protection shall be provided on all power outputs. The power supply shall provide an integral battery charger or may be used with an external battery and charger systems. Battery arrangement may be configured in the field.
4. The main power supply shall continuously monitor all field wires for earth ground conditions.

5. The main power supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP.
   a. Programmable Electronic Sounders:
6. Electronic sounders shall operate on 24 VDC nominal.
7. Electronic sounders shall be field programmable without the use of special tools, to provide slow whoop, continuous, or interrupted tones with an output sound level of at least 90 dBA measured at 10 feet from the device.
8. Electronic sounders shall be flush or surface mounted as shown on plans.
9. Strobe lights shall meet the requirements of the ADA, UL Standard 1971 and shall meet the following criteria:
   a. The maximum pulse duration shall be 2/10 of one second.
   b. Strobe intensity shall meet the requirements of UL 1971.
   c. The flash rate shall meet the requirements of UL 1971.
   d. Audible/Visual Combination Devices:
   e. Shall meet the applicable requirements of Section A listed above for audibility.
   f. Shall meet the requirements of Section B listed above for visibility.
      1) Specific System Operations
   g. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently programmed for verification of alarm signals. The alarm verification time shall not exceed 2 minutes.
   h. Point Disable: Any addressable device or conventional circuit in the system may be enabled or disabled through the system keypad.
   i. Point Read: The system shall be able to display the following point status diagnostic functions:
   j. Device status
   k. Device type
   l. Custom device label
   m. Device zone assignments
   n. System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing all system status.
   o. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 500 events. Each of these activations will be stored and time and date stamped with the actual time of the activation. The contents of the history buffer may be manually reviewed, one event at a time, or printed in its entirety.
      1) The history buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable substitutes.
   p. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent detector and shall analyze the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is above or below normal limits, then the system will enter the trouble mode, and the particular detector will be annunciated on the system display. This

feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.

q. Pre-Alarm Function: The system shall provide two levels of pre-alarm warning to give advance notice of a possible fire situation. Both pre-alarm levels shall be fully field adjustable. The first level shall give an audible indication at the panel. The second level shall give an audible indication and may also activate control relays. The system shall also have the ability to activate local detector sounder bases at the pre-alarm level, to assist in avoiding nuisance alarms.
   1) The fire alarm control panel shall include Silent and Audible Walk Test functions –
   2) Silent and Audible. It shall include the ability to test initiating device circuits and Notification Appliance Circuits from the field without returning to the panel to reset the system. The operation shall be as follows:
   3) The Silent Walk Test will not sound NACs but will store the Walk Test information in History for later viewing.
   4) Alarming an initiating device shall activate programmed outputs, which are selected to participate in Walk Test.
   5) Introducing a trouble into the initiating device shall activate the programmed outputs.
   6) Walk Test shall be selectable on a per device/circuit basis. All devices and circuits which are not selected for Walk Test shall continue to provide fire protection and if an alarm is detected, will exit Walk Test and activate all programmed alarm functions.
   7) All devices tested in walk test shall be recorded in the history buffer.

r. Waterflow Operation: An alarm from a waterflow detection device shall activate the appropriate alarm message on the control panel display; turn on all programmed Notification Appliance Circuits and shall not be affected by the Signal Silence switch.

s. Supervisory Operation: An alarm from a supervisory device shall cause the appropriate indication on the control panel display, light a common supervisory LED, but will not cause the system to enter the trouble mode.

t. Signal Silence Operation: The FACP shall have the ability to program each output circuit (notification circuit or relay) to deactivate upon depression of the Signal Silence switch.

u. Non-Alarm Input Operation: Any addressable initiating device in the system may be used as a non-alarm input to monitor normally open contact type devices. Non-alarm functions are a lower priority than fire alarm initiating devices.

v. Programmable functionality: programmable buttons F1, F2, F3, F4 to allow simple routine maintenance tasks be programmed.

w. Detection of unprogrammed devices: The FACP will automatically detect and report unprogrammed SLC devices to ensure all devices are recognized.

2.04 SYSTEM COMPONENTS:

A Addressable Pull Box (manual station)

1. Addressable pull boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
3. Manual pull stations shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.

B Intelligent Multi-Sensing Detector

1. The intelligent detector shall be an addressable device which is capable of detecting multiple threats by employing photoelectric and thermal technologies in a single unit. This detector shall utilize advanced electronics which react to slow smoldering fires (photoelectric) and heat (thermal) all within a single sensing device.
2. The multi-detector shall include two LEDs for 360-degree viewing.
3. Automatically adjusts sensitivity levels without the need for operator intervention or programming. Sensitivity increases with heat.

C Intelligent Photoelectric Smoke Detector

1. The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.
   a. The detectors shall be ceiling-mounted and available in an alternate model with an integral fixed 135-degree heat-sensing element.
   b. Each detector shall contain a remote LED output and a built-in test switch.
   c. Detector shall be provided on a twist-lock base.
   d. It shall be possible to perform a calibrated sensitivity and performance test on the detector without the need for the generation of smoke. The test method shall test all detector circuits.
2. A visual indication of an alarm shall be provided by dual latching Light Emitting Diodes (LEDs), on the detector, which may be seen from ground level over 360 degrees. These LEDs shall periodically flash to indicate that the detector is in communication with the control panel.
3. The detector shall not go into alarm when exposed to air velocities of up to 1500 feet per minute (fpm).
4. The detector screen and cover assembly shall be easily removable for field cleaning of the detector chamber.
5. All field wire connections shall be made to the base through the use of a clamping plate and screw.

D Projected Addressable Beam Detector

1. The projected beam type shall be a 4-wire 24 VDC intelligent, addressable projected beam smoke detector device.
2. The detector shall be listed to UL 268 and shall consist of a single transmitter\receiver and corresponding non powered reflector.

3. The detector shall operate in either a short range (16' - 230') or long range (16' - 328') when used with an extender module.
4. The temperature range of the device shall be -22 degrees F to 131 degrees
5. The detector shall feature an optical sight and 2-digit signal strength meter to ensure proper alignment of unit without the need of special tools.
6. The unit shall be both ceiling and wall mountable.
7. The detector shall have the ability to be tested using calibrated test filters or magnet-activated remote test station.}
8. The detector shall have four standard sensitivity selections along with two automatic self-adjusting settings. When either of the two automatic settings is selected the detector will automatically adjust its sensitivity using advanced software algorithms to select the optimum sensitivity for the specific environment.

E Intelligent Ionization Smoke Detector

1. The detectors shall use the dual-chamber ionization principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analog level of products of combustion.

F Intelligent Thermal Detectors

1. Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C)
   a. per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit.

G Multicriteria Fire/CO Detectors

a. Fire detector combines four separate sensing elements in one unit (smoke, CO, light/flame, and heat) to sense multiple components of a fire with programmable response.

H Intelligent Duct Smoke Detector

a. The smoke detector housing shall accommodate either an intelligent ionization detector or an intelligent photoelectric detector, of that provides continuous analog monitoring and alarm verification from the panel.
b. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.

I Addressable Dry Contact Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any normally open dry contact device) to one of the fire alarm control panel SLCs.
2. The monitor module shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box.
3. The IDC zone shall be suitable for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

4. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.

J Two-Wire Detector Monitoring

1. Means shall be provided for the monitoring of conventional Initiating Device Circuits populated with 2-wire smoke detectors as well as normally-open contact alarm initiating devices (pull stations, heat detectors, etc).
2. Each IDC of conventional devices will be monitored as a distinct address on the polling circuit by an addressable module. The module will supervise the IDC for alarms and circuit integrity (opens).
3. The monitoring module will be compatible, and listed as such, with all devices on the supervised circuit.
4. The IDC zone may be wired for Style D or Style B (Class A or B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
5. The monitoring module shall be capable of mounting in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box or in an surface mount backbox.

K Addressable Control Relay Module

1. Addressable control relay modules shall be provided to control the operation of fan shutdown and other auxiliary control functions.
2. The control module shall mount in a standard 4-inch square, 2-1/8 inch deep electrical box, or to a surface mounted backbox.
3. The control relay module will provide a dry contact, Form-C relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relays may be energized at the same time on the same pair of wires.
4. The control relay module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.

L Six Output Addressable Control Relay Module

1. Up to 6 Addressable intelligent control relay modules combined on one circuit board shall be provided to control the operation of fan shutdown and other auxiliary control functions.
2. Using rotary address switches, the first module shall be addressed from 01 to 45 while the remaining modules shall be automatically assigned to the next five higher addresses. Note, binary dip switches for setting address are not acceptable.
3. Provision shall be included for disabling a maximum of three unused modules
4. A single isolated set of dry relay form C contacts shall be provided for each of the 6 module addresses, which shall be capable of being wired for either a normally-open or normally-closed operation.
5. The module shall allow an addressable control panel to switch these contacts on command.
6. The module shall contain removable plug in terminal blocks capable of supporting 12 AWG to 18 AWG wire.
7. The control relays mounted on the module shall be suitable for pilot duty applications and rated for a maximum of 3.0 amps at 30 VDC, resistive, non-coded and 2.0 amps at 30 VDC maximum, resistive, coded.

M Six-Zone Interface Module

1. A six-zone interface module shall be provided as an interface between the addressable panel and two-wire conventional detection zones.
2. A common SLC input shall be used for all modules, and the initiating device circuits shall share a common external supervisory supply and ground.
3. The first address on the interface module shall be addressed from 01 to 45 while the remaining modules are automatically assigned to the next five higher addresses.
4. Address shall be set using decimal encoded rotary address switches. Binary address switches are not acceptable.
5. Provision shall be included for disabling a maximum of two unused addresses of the six available.
6. All two-wire detectors being monitored shall be two-wire compatibility listed with the six zone input module.
7. The six-zone input module shall transmit the status of a zone of two-wire detectors to the fire alarm control panel. Status shall be reported as normal, open or alarm.
8. Removable plug-in terminals shall be provided capable of accepting from 18 AWG up to 12 AWG wire.

N Multiple Two-Wire Detector Monitoring

1. A single multi-input module shall be provided for the monitoring of up to 10 conventional Initiating Device Circuits populated with 2-wire smoke detectors as well as normally-open contact alarm initiating devices (pull stations, heat detectors, etc).
2. Each IDC of conventional devices will be monitored as a distinct address on the polling circuit by an addressable point. The module will supervise the IDC for alarms and circuit integrity (opens).
3. The first address on the 10 input boards shall be set from 01 to 40 and the remaining module addresses shall be automatically assigned to the next nine higher addresses.
4. Provision shall be included for disabling a maximum of two unused addresses.
5. The supervised state (normal, open, or short) of the monitored device shall be sent back to the panel. A common SLC input shall be used for all modules, and the initiating device loops shall share a common supervisory supply and ground.
6. The IDC zone may be wired for Style D or Style B (Class A or B) operation. A green LED for each circuit shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel. LEDs shall latch on when a circuit is in alarm.

O Isolator Module

1. Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Style 6 (Class A) or Style 4 (Class B branch). The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building.
2. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.

3. The isolator module shall not require any address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
4. The isolator module shall mount in a standard 4-inch (101.6 mm) deep electrical box or in a surface mounted backbox. It shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

P Serially Connected Graphic LED driver module

1. An LED driver module shall communicate with the fire alarm control panel via a two wire EIA 485 (multi-drop) communications circuit.
2. The annunciator shall require no more than two wires for operation and two wires for power. Annunciation shall include Outputs for up to 40 LEDs.
    1) a. Up to 8 total devices of any kind, LCD, printer gateway, LED, Relay or I/O module may be installed on the ANN-BUS.

Q Alphanumeric LCD Type Annunciator:

1. The alphanumeric display annunciator shall be a supervised, remotely located back-lit eighty (80) characters LCD display for alarm annunciation in clear English text.
2. The LCD annunciator shall display all alarm and trouble conditions in the system.
3. An audible indication of alarm shall be integral to the alphanumeric display.
4. The display shall be UL listed for fire alarm application.
5. It shall be possible to connect up to 8 LCD displays and be capable of wiring distances up to 6,000 feet from the control panel.
6. The annunciator shall connect to a separate, dedicated "terminal mode" EIA-RS-485 interface using two-wire loop connection and 2 wires for power. Each terminal mode LCD display shall mimic the main control panel.

R Field Wiring Terminal Blocks

1. For ease of connection for heavy solid gage wire, all panel I/O wiring terminal blocks shall be screw type barrier strips and have sufficient capacity for #18 to #12 AWG wire.
    a. SYSTEM COMPONENTS - ADDRESSABLE DEVICES

S Addressable Devices - General

1. Addressable devices shall employ the simple-to-set decade addressing scheme. Addressable devices which use a binary-coded address setting method, such as a DIP switch, are not an allowable substitute.
2. Detectors shall be addressable and intelligent, and shall connect with two wires to the fire alarm control panel signaling line circuits.
3. Addressable smoke and thermal (heat) detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED.
4. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The

detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 10.

5. Detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Base options shall include a base with a built-in (local) sounder rated for a minimum of 85 DBA, a relay base and an isolator base designed for Style 7 applications.
6. Detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel.
7. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL, CO).
8. Detectors shall provide address-setting means using decimal switches.
   a. BATTERIES:

T Upon loss of Primary (AC) power to the control panel, the batteries shall have sufficient capacity to power the fire alarm system for required standby time (24 or 60 hours) followed by 5 minutes of alarm.

U The batteries are to be completely maintenance free. No liquids are required. Fluid level checks for refilling, spills, and leakage shall not be required.

V If necessary to meet standby requirements, external battery/charger systems may be used.

PART 3.0 - EXECUTION

3.01 DEMOLITION AND PHASING OF WORK

A Where the project schedule requires work to be phased, including phasing of demolition work, renovation work, and new construction, the contractor shall provide all required labor and materials needed to re-program the fire alarm system between phases of work to ensure proper functioning of the system for the duration of the work in addition to any programming required at the completion of construction.

B Where removal of fire alarm devices is required to complete new construction work, the devices shall be removed, and the system shall be reprogrammed to restore the system to a fully functional state prior to commencing new work.

C After demolition of devices, the Fire Alarm Control Panel shall be free from trouble signals, faults, or other deficiencies prior to commencing new work. Contractor shall provide all required labor and materials needed to troubleshoot the panel and correct all deficiencies prior to commencing new work.

D Where reprogramming can not be accomplished, the contractor shall provide a fire watch in accordance with CFC and DSA requirements for the duration of the outage.

3.02 INSTALLATION:

A Equipment, materials, installation, workmanship, inspection, and testing shall be in accordance with the NFPA publications and as modified herein.

B Follow manufacturers' directions in all cases for installation, testing and energizing.

C Accurately set, level, support and fasten all equipment.

D Batteries:

1. All batteries shall have the date of installation hand written on the side in a location clearly visible to service personnel.
2. Replace any existing batteries over 4 years old or of unknown age with new compatible, rechargeable, gelled electrolyte, totally sealed, fully charged batteries.

E Smoke and heat detectors:
1. Locate detectors in accordance with NFPA 72. If the proposed type of detector has an area coverage capability less than required by NFPA 72, revise detector layout and submit for approval with the detail drawings. Mount detectors at the underside of ceiling or roof decks unless otherwise indicated.
2. No detector shall be located closer than 12 inches to any part of any lighting fixture. Detectors, located in areas subject to moisture or exterior atmospheric conditions, or hazardous locations as defined by NFPA 70, shall be approved for such locations.
3. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

F Conduit where exposed shall be installed parallel with walls or structural elements; vertical runs to be plumb; horizontal runs level or parallel with structure; conduit grouped neatly together with straight runs, all bends parallels and uniformly spaced.

G Earthquake Resistant installation/fastening of all electrical equipment shall conform to seismic code requirements. Where anchorage details are shown or not shown on the Drawings, the field installation shall be approved by a Structural Engineer.

H All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

I Manual fire alarm boxes shall be suitable for surface mounting or semi-flush mounting as shown on the plans, and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor.

3.03 PRELIMINARY TESTS:

A Before final acceptance of the work, pre-test system to demonstrate compliance with the contract requirements. System shall be subjected to complete functional and operational tests, including tests in place for each detector. Correct deficiencies pertaining to these requirements prior to formal functional and operational tests of the system. When tests have been completed and corrections made, submit test results and a signed and dated request for formal inspection and final test witnessing.

B Conduct the following tests during installation of wiring and system components. Preliminary test shall be performed in the presence of the Local Fire Authority and Project Inspector of Record to determine conformance with the specified requirements:
1. Visually inspect all strobes and horn/strobes to ensure that strobe settings are as shown on the drawings.
2. Ground Resistance:
   a. Measure the resistance of each connection to ground. Ground resistance shall not exceed 10 ohms.
3. Dielectric Strength and Insulation Resistance:
   a. Test the dielectric strength and the insulating resistance of the system interconnecting wiring by means of an instrument capable of generating 500 volts DC and equipped to indicate leakage current in megohms. For the purpose of this test, connect the instrument between each conductor on the line and between each conductor and ground

at the control panel end of the line, with the other extremity open circuited and all series-connected devices in place. The system shall withstand the test without breakdown and shall indicate a resistance of not less than 50 megohms, the measurement being taken after an electrification of 1.0 minute with a DC potential of 500 volts.

4. Standby Battery Test:
   a. Prior to formal inspection and tests, place the fire alarm system on standby battery power for twenty-four (24) hours; immediately thereafter, sound the building evacuation alarm signaling devices for 5 minutes. When the test is complete, allow fire alarm system battery charger to recharge the standby batteries for 24 hours and place the fire alarm system on standby battery power for an additional twenty-four (24) hours; immediately thereafter, sound the building evacuation alarm signaling devices for 5 minutes. Certify that the Fire Alarm System has satisfactorily sounded building evacuation alarms for 5 minutes after the second twenty-four (24) hours on battery power.

3.04 FIELD INSPECTION AND FINAL TEST:

A Perform the formal inspection and final test in the presence of the in the presence of the manufacturer's representative, the owners representative, Local Fire Authority and Project Inspector of Record (IOR). NFPA 72 "Inspection and Testing Form" shall be filled out completely and signed by those performing and witnessing the final test:

1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
2. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.
3. Verify activation of all waterflow switches.
4. Open initiating device circuits and verify that the trouble signal actuates.
5. Open and short signaling line circuits and verify that the trouble signal actuates.
6. Open and short notification appliance circuits and verify that trouble signal actuates.
7. Ground all circuits and verify response of trouble signals.
8. Check presence and audibility of tone at all alarm notification devices.
9. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.
10. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.
11. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.
12. Test 100% of all automatic fire detection devices:
    a. Where application of heat would destroy any heat detector, it may be manually activated.
13. The communication loops and the indicating appliance circuits shall be opened in at least two (2) locations per zone to check for the presence of correct supervisory circuitry.

B Test Equipment: It shall be the responsibility of the installing Contractor to furnish tools, instruments, and materials required for the thorough test of the system. This includes, but is not limited to, the following:
1. VOM meter
2. Manufacturers recommended smoke detector testing device and sensitivity test equipment.
3. Heat source for testing rate of rise heat detectors.
4. Keys to all control panels
5. Ladders

3.05 TRAINING:

A Provide minimum four hours on site training by FACP manufacturer factory trained and authorized personnel.

B Training sessions shall provide:
1. Instruction on operating the fire alarm system.
2. "Hands-on" demonstrations of the operations of all system components.
3. Instruct process for changing program and functions.

C Permanently attach Sequence of Operation for fire alarm panel on wall next to FACP. Coordinate exact location with Owner.

3.06 PROJECT CLOSEOUT:

A As Built Drawings:
1. Provide in accordance with section 28 05 00.
2. Provide a complete set of reproducible "as-built" drawings showing installed wiring, color coding, and wire tag notations for exact locations of all installed equipment, specific interconnections between all equipment, and internal wiring of the equipment upon completion of system:
   a. Drawings shall include actual voltage drop calculations as installed for all new or modified notifications circuits.
   b. Drawings shall include actual battery calculations as installed for any new FACP’s or RNPS’s or any FACP’s or RNPS’s whose loads have been modified.

B Operating and Instruction Manuals:
1. Operating and instruction manuals shall be submitted prior to testing of the system. Four (4) complete sets of operating and instruction manuals shall be delivered to the owner upon completion.
2. Complete, accurate, step-by-step testing instructions giving recommended and required testing frequency of all equipment, methods for testing each individual piece of equipment, and a trouble shooting manual explaining how to test the primary internal parts of each piece of equipment shall be delivered to the owner upon completion of the system.
3. Maintenance instructions shall be complete, easy to read, understandable, and shall provide the following information:
   a. Instruction on replacing any components of the system, including internal parts.
   b. Instructions on periodic cleaning and adjustment 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 provided prominently displayed on a separate sheet located next to the control unit in accordance with U.L. Standard 864.

END OF SECTION

SECTION 31 05 13
SOILS FOR EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

A. All grading, earthwork, excavations, backfills, compaction, and other grading operations shall be accomplished in accordance with Caltrans Standard Specifications, 2010 edition. Contractor shall be responsible for securing a copy of the soils report. A soil testing firm shall be present during all grading operations. The soil testing firm shall direct samples to be submitted and tests to be taken. Contractor shall cooperate with the requirements of the soil testing firm.

B. Related Sections:

1. Section 31 22 13 - Rough Grading.
2. Section 31 23 23.13 - Backfill.
3. Section 31 23 16.13 - Trenching.
4. Section 32 13 13 – Concrete Paving.
5. Section 32 11 23 - Aggregate Base Course.

1.2 REFERENCES

A. Caltrans Standard Specifications, 2010 edition.

PART 2 PRODUCTS

2.1 TOPSOIL MATERIALS

A. Class II Permeable Material shall meet the requirement of Caltrans Standard Specifications 68-1.025.

PART 3 EXECUTION

3.1 SOIL REMOVAL

A. Conduct earthwork operations in accordance with the provisions of the Caltrans Standard Specifications and any supplements to the Caltrans Standard Specifications, and as directed by the soil testing firm.

END OF SECTION

SECTION 31 10 00
SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes removal of surface debris; removal of paving, curbs, sidewalks; removal of trees, shrubs, and other plant life; removal of underground storage tanks; and removal of abandoned utilities.

B. Related Sections:
1. Section 31 05 13 – Soils for Earthwork.
2. Section 31 22 13 - Rough Grading.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 PREPARATION

A. Verify that existing plant life designated to remain is tagged or identified.

B. Removed materials are to be removed from the site and disposed of in a lawful manner.

3.2 PROTECTION

A. Locate, identify, and protect utilities from damage that are to remain.

B. Protect trees, plant growth, and features designated to remain.

C. Protect benchmarks, survey control points, and existing structures from damage or displacement.

3.3 CLEARING

A. Clear areas required for access to site and execution of Work.

B. Remove trees and shrubs indicated and in a manner specified on the drawings or in these specifications. Remove tree and shrub root bulbs in their entirety and to a maximum root diameter of one inch.

3.4 REMOVAL

A. Remove debris, rock, and extracted plant life from site to the limits indicated on the drawings.

B. Remove paving, curbs, and concrete from the site to the limits indicated on the drawings.

C. Neatly saw cut edges at limits indicated for all pavement, curbs, and walkways to be removed.

D. Excavate and remove any underground storage tanks and associated plumbing piping, as indicated on the drawings.

3.5 TOPSOIL EXCAVATION

A. Excavate topsoil from areas to be further excavated, relandscaped, or regraded, without mixing with foreign materials for use in finish grading.

B. Stockpile on site and protect from erosion.

C. Remove excess topsoil not intended for reuse, from site.

END OF SECTION

SECTION 31 22 13
ROUGH GRADING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes removal of topsoil and cutting, grading, filling, rough contouring, and compacting as indicated on the drawings.

B. Related Sections:

1. Section 31 05 13 - Soils for Earthwork.
2. Section 31 10 00 - Site Clearing.
3. Section 31 23 00 - Excavation and Fill.
4. Section 31 23 16.13 - Trenching.
5. Section 31 23 23.13 - Backfill.
6. Section 32 96 00 – Landscape Planting.

1.2 REFERENCES

A. The provisions of the project Soils Report and any supplements to the Soils Report shall be adhered to for rough grading of the site.

1.3 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

PART 2 PRODUCTS

2.1 MATERIALS

A. Topsoil: as specified in Section 32 90 00 Planting.

B. Other Fill Materials: shall adhere to the provisions of the project Soils Report and any supplements to the Soils Report.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements.

B. Verify site conditions.

C. Verify that survey benchmark and intended elevations for the Work are as indicated.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Stake and flag locations of known utilities.

C. Locate, identify, and protect from damage utilities that are to remain.

D. Notify affected utility companies to remove or relocate public utilities indicated on the plans to be removed or relocated by the utility company.

E. Protect above and below grade utilities that are to remain.

F. Protect plant life, lawns, and other features remaining as a portion of final landscaping.

G. Protect bench marks, survey control point, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.3 SOIL EXCAVATION

A. Excavate soil from areas to be further excavated, relandscaped, or regraded. as shown on the drawings.

B. When excavating through roots, for trees to remain, perform work by hand and cut roots with sharp axe.

C. Remove excess soil from site.

D. Benching Slopes: Horizontally bench existing slopes steeper than 1:4 (vertical:horizontal) to key placed fill material to slope to provide firm bearing as required by the Soils Report and any supplements to the Soils Report. Minimum horizontal bench shall be 2 feet wide.

E. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.4 FILLING

A. Install Work in accordance with the project Soils Report and any supplements to the Soils Report.

B. Fill areas to contours and elevations with suitable materials.

C. Place fill material on continuous layers and compact in accordance with the project Soils Report and any supplements to the Soils Report.

D. Maintain optimum moisture content of fill materials to attain required compaction density.

E. Slope grade away from buildings at a minimum slope of two (2%) percent unless noted otherwise.

F. Make grade changes gradual. Blend slope into level areas.

G. Remove surplus fill materials from site.

3.5 TOLERANCES

A. Section 01 40 00 - Quality Requirements.

B. Top Surface of Subgrade: Plus or minus 0.05 feet from required elevation on paved or walkway areas and zero (0) feet to minus 0.10 foot in building pad areas.

3.6 FIELD QUALITY CONTROL

A. Testing and inspection shall be provided by the project soils engineer.

B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at the Contractor’s sole expense.

END OF SECTION

SECTION 31 23 00
EXCAVATION AND FILL

PART 1 GENERAL

1.1 SUMMARY

A. Section includes excavating for building foundations, roads, parking areas, site grading, slabs-on-grade, landscaping areas, and for site structures.

B. Related Sections:

1. Section 31 05 13 – Soils for Earthwork.
2. Section 31 22 13 - Rough Grading.
3. Section 31 23 16.13 - Trenching.
4. Section 31 23 23.13 - Backfill.

1.2 REFERENCES

A. The project Soils Report and any supplements to the Soils Report.

B. Local utility standards when working within 24 inches of the respective utility lines.

PART 2 PRODUCTS

A. Bio-Retention Soils

1. Permeable Class II Aggregate Base or crushed drain rock.

2. Planting soil is 60% sand, 40% compost mix allowing 5”/hour percolation.

PART 3 EXECUTION

3.1 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

3.2 EXCAVATING

A. Underpin adjacent structures which may be damaged by excavating work.

B. Excavate subsoil to accommodate building foundations, slabs-on-grade, paving and site structures.

C. Compact disturbed load bearing soil in direct contact with foundations to original bearing capacity; perform compaction in accordance with Section 31 23 23.13 and 31 23 16.13.

D. Slope banks with machine to angle of repose or less until shored.

E. Do not interfere with 45 degree bearing splay of foundations.

F. Grade top perimeter of excavating to prevent surface water from draining into excavation.

G. Hand trim excavation. Remove loose matter.

H. Remove lumped subsoil, boulders, and rock in accordance with the provisions of the Soils Report and any supplements to the Soils Report.

I. Notify Architect/Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume Work.

J. Correct areas over excavated with backfill and compact replacement as specified for authorized excavation.

K. Remove excess excavated material from site.

3.3 FIELD QUALITY CONTROL

A. The project Soils Engineer shall provide testing and inspection services.

3.4 PROTECTION

A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.

B. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

END OF SECTION

SECTION 31 23 16.13
TRENCHING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes excavating trenches for utilities from outside building to final connection point or public right-of-way or utility; compacted fill from top of utility bedding to subgrade elevations; and backfilling and compaction.

B. Related Sections:

1. Section 31 05 13 – Soils for Earthwork.
2. Section 31 22 13 - Rough Grading.
3. Section 31 23 00 - Excavation and Fill.
4. Section 31 23 23.13 - Backfill.
5. Section 32 13 13 – Concrete Paving.

1.2 REFERENCES

A. Caltrans Standard Specifications, 2010 edition.

1.3 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

1.4 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.5 COORDINATION

A. Section 01 30 00 - Administrative Requirements.

B. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

C. Verify elevations of existing facilities prior to placing new Work.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Fill and Structural Fill shall be: As specified in the Caltrans Standard Specifications and any supplements to the Caltrans Standard Specifications.

2.2 ACCESSORIES

A. Filter Fabric: Non-biodegradable, woven as manufactured by TC Mirafi, Tenax Corp., Tensar Earth Technologies, Inc. or equal.

PART 3 EXECUTION

3.1 LINES AND GRADES

A. Grades
   1. Pipes shall be laid true to the lines and grades indicated.
   2. The grade alignment of the pipe shall be maintained by the use of a string line parallel with the grade line and vertically above the centerline of the pipe. This line shall be established on level batter boards at intervals of not more than 25 feet. Batter boards shall span the trench and be rigidly anchored to substantial posts driven into the ground on each side of the trench. Three adjacent batter boards must be set before laying pipe to provide a check on the grades and line. Elevation and position of the string line shall be determined from the elevation and position of offset points or stakes located along the pipe route. Pipe shall not be laid using side lines for line or grade.
   3. As an alternative means of establishing alignment and grade, a "Laser-Beam" instrument may be utilized with a competent operator.

B. Location of Pipe Lines:
   1. The location and approximate depths of the proposed pipe lines are shown on the Drawings.
   2. An underground locate service shall be enlisted to discover the location of existing utilities regardless if they are shown on the drawings.
   3. The Architect/Engineer reserves the right to make changes in lines, grades, and depths of pipe lines and manholes when such changes are necessary.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. Protect plant life, lawns, and other features remaining as a portion of final landscaping.

C. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

D. Maintain and protect above and below grade utilities which are to remain.

E. Cut out soft areas of subgrade not capable of compaction in place. Backfill and compact to density equal to or greater than requirements for subsequent backfill material.

3.3 EXCAVATING

A. Excavate subsoil required for utilities.

B. Cut trenches sufficiently wide to enable installation and allow inspection. Remove water or materials that interfere with Work.

C. Do not interfere with 45 degree bearing splay of foundations.

D. Hand trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.

E. Remove lumped subsoil, boulders, and rock as directed by the soil testing firm or other inspector.

F. Correct over excavated areas with backfill and compact replacement as specified for

authorized excavation.

G. Stockpile excavated material on site. Remove excess material not being used from site.

3.4 TRENCHING

A. Excavations:
1. Excavation shall be dug so that the pipe can be laid and jointed properly. The trench shall be made so that the pipe can be laid to the alignment and depth as shown on the Drawings, and it shall be excavated only so far in advance of pipe laying as permitted by the Architect/Engineer. The excavation shall not be more than two feet wider at the bottom than the outside diameter of the pipe or structure. If there is no interference with construction, or adjacent property, and if soil permits, the Contractor at his own expense shall be permitted to slope the side walls of the excavation starting at a point two (2) feet above the top of pipe.
2. The trench shall be excavated to the depth required so as to provide a uniform and continuous bearing and support for the pipe on bedding material at every point between joints, except where pipe slings or other lifting tackle are withdrawn.
3. Excavation Below Grade:
1) Where excavation indicates that the subsurface materials at the bottom of the trench are in a loose or soft state, the Contractor shall be advised to excavate to a depth where suitable material is encountered, as directed by the Architect/Engineer.
2) Where the bottom of the trench has been excavated by mistake to a greater depth than required, the Contractor shall refill this area using approved material. No additional compensation shall be given to the Contractor. Refilling with earth to bring the bottom of the trench to the proper grade will not be permitted.

4. Excavation within 24 inches of existing utilities shall be governed by specifications of the Owner of the respective utility. The Contractor shall obtain these specifications and follow the same at no extra cost.
5. Excavation and shoring shall adhere to the requirements and safety standards set by OSHA.

B. Trenching in Advance of Pipe Laying: The trench for the pipe lines shall not be opened for a distance of more than 200 feet at any one time, unless authorized by the Architect/Engineer. At no time will the Contractor be permitted to leave more than 50 feet of trench open at the end of a working day. Adequate protection of open trench shall be provided by the Contractor and the Contractor shall be responsible therefore.

3.5 SHEETING AND BRACING

A. General:
1. Sheeting and bracing of all excavations shall conform to the latest statutes of the State of California governing safety of workers in the construction industry. When necessary, in the opinion of the Contractor, adequate sheeting and bracing shall be installed to prevent ground movement that may cause damage or settlement to adjacent structures, pipelines and utilities. Any damage due to settlement because of failure to use sheeting or because of inadequate bracing, or through negligence or fault of the Contractor in any other manner, shall be repaired at the Contractor's expense.
2. Sides of trenches in unsuitable, loose or soft material, five feet or more in depth, shall be shored, sheeted, braced, sloped, or otherwise supported by means of

sufficient strength to protect employees working within them.

B. Sheeting Requirements:
   3. Where excavations are made with vertical sides which require supporting, the sheeting and bracing shall be of sufficient strength to sustain the sides of the excavations and to prevent movement which could in any way injure the Work, or adjacent structures, or diminish the working space sufficiently to delay the Work. Special precautions shall be taken where there is additional pressure due to the presence of other structures.
   4. It shall be the Contractor's responsibility to select sheeting and bracing of sufficient dimensions and strength and type to adequately support the sides of trenches and excavations.
   5. Sheeting and bracing shall be removed before the completion of the Work.

3.6 BACKFILLING

A. Backfill trenches to contours and elevations shown on the drawings.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, or spongy subgrade surfaces.

C. Fill materials shall be as specified in the Caltrans Standard Specifications and any supplements to the Caltrans Standard Specifications.

D. Employ a placement method that does not disturb or damage utilities in trench. Jetting of backfill materials to achieve compaction shall not be permitted.

E. Maintain optimum moisture content of fill materials to attain required compaction density.

F. Remove surplus fill materials from site.

3.7 TOLERANCES

A. Section 01 45 00 - Quality Requirements.

B. Top Surface of Backfilling Under Paved Areas: Plus or minus 0.05 feet from required elevations.

C. Top Surface of General Backfilling: Plus or minus 1/10 feet from required elevations.

3.8 FIELD QUALITY CONTROL

A. Compaction testing will be performed by the soil testing firm.

B. If tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.

3.9 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Reshape and re-compact fills subjected to vehicular traffic during construction.

END OF SECTION

SECTION 31 23 23.13
BACKFILL

PART 1 GENERAL

1.1 SUMMARY

A. Section includes building perimeter and site structure, filling and backfilling to subgrade elevations; fill under slabs-on-grade, paving; fill for over-excavation; consolidation and compaction as specified in the Caltrans Standard Specifications and any supplements to the Caltrans Standard Specifications.

B. Related Sections:

1. Section 31 05 13 – Soils for Earthwork.
2. Section 31 23 00 - Excavation and Fill.
3. Section 31 23 16.13 - Trenching.
4. Section 32 13 13 – Concrete Paving.

1.2 REFERENCES

A. Caltrans Standard Specifications, 2010 edition.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Fill and Structural Fill as specified in the Caltrans Standard Specifications and any supplements to the Caltrans Standard Specifications.

2.2 ACCESSORIES

A. Geotextile Fabric: Non-biodegradable, woven as manufactured by TC Mirafi, Tensar Earth Technologies, Inc. or equal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.

C. Verify structural ability of unsupported walls to support loads imposed by the fill.

3.2 PREPARATION

A. Compact subgrade to density requirements for subsequent backfill materials.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill and compact to density equal to or greater than requirements for subsequent fill material.

C. Roll subgrade surface to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

3.3 BACKFILLING

A. Backfill areas to contours and elevations shown on drawings.

B. Employ a placement method that does not disturb or damage other work.

C. Maintain optimum moisture content of backfill materials to attain required compaction density.

D. Backfill against supported walls and structures. Do not backfill against unsupported walls or structures.

E. Backfill simultaneously on each side of unsupported walls and structures until supports are in place.

F. Slope grade away from building at a minimum slope of two (2%) percent, unless noted otherwise.

G. Make gradual grade changes. Blend slope into level areas.

H. Remove surplus backfill materials from site.

3.4 TOLERANCES

A. Section 01 40 00 - Quality Requirements.

B. Top Surface of Backfilling Under Paved Areas: Plus or minus 0.05 feet from required elevations.

C. Top Surface of General Backfilling: Plus or minus 1/10 feet from required elevations.

3.5 FIELD QUALITY CONTROL

A. The soil testing firm shall provide testing and inspection services.

3.6 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Reshape and re-compact fills subjected to vehicular traffic.

END OF SECTION

SECTION 31 23 23.14
CONTROLLED LOW STRENGTH MATERIAL

PART 1 GENERAL

1.1 SUMMARY

A. Section includes material for use in trench backfill where conditions require controlled density fill.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, general and supplementary conditions and Division 1 Specification Sections apply to this Section.

B. Related Sections
1. Section 31 23 16 13 – Trenching
2. Section 31 23 23.13 – Backfill
3. Section 32 11 23 – Aggregate Base Course
4. Divisions 14, 15 and 16, as applies to excavating, trenching and backfill.

1.3 REFERENCES

A. ASTM C-33
B. ASTM C-231
C. ASTM C-150, Type II
D. ASTM C-260
E. ASTM C-618, Class F
F. California Building Code Section 1806A.11 – Pipes and Trenches.
G. Caltrans Standard Specifications, 2010 edition

1.4 SUBMITTALS

A. Refer to Section 01 33 00 for submittal procedures.

B. Contractor shall submit concrete, mortar and grout mix designs, recent test data for submitted mixes, and test data for mix components confirming that the mixes meet the requirements of this section.

PART 2 GENERAL

2.1 COMPONENTS

A. Controlled Low Strength Material (CLSM) mix shall be composed of a cementitious material, water, fine and course aggregate, and an admixture.

B. The cementitious materials shall be Portland cement in combination with fly ash.

C. The admixture shall be an air-entraining agent.

D. The proportions of all material used in the CLSM shall conform to the mix design.

E. CLSM shall have an unconfined compressive 28-day strength from 50 psi to a maximum of 150 psi. CLSM with a 28-day compressive strength in excess of 200 psi shall be removed and replaced by the contractor as directed by the Engineer/IOR at no cost to the School District.

F. CLSM shall have a minimum set time of 24 hours.

2.2 AGGREGATE CONTENT

A. Aggregate need not conform to ASTM C-33. Any aggregates which produce performance characteristics of the CLSM may be submitted for approval.

B. CLSM mixture shall contain no aggregate that is larger than 3/8 inch.

C. The amount of material passing No. 200 sieve shall not exceed 12.0 percent.

D. No plastic fines shall be present.

2.3 AIR CONTENT

A. The air content by volume based on measurement immediately after discharge from the mixer shall be determined by ASTM C-231.

B. The total calculated air content of the sample prepared in accordance with ASTM C-231 shall not exceed 6.0 percent.

2.4 COMPONENT MATERIALS

Material	Weight	Sp. Gr.	Abs. Vol.
Cement	30 lb	3.15	0.152
Fly Ash	300 lb	2.30	2.09
Water	317 lb	1.00	5.08
Course Aggregate	1645 lb	2.68	8.76
Fine Aggregate	1465 lb	2.68	9.835
Admixture	4 oz	===	1.08
Total	3757 lb	===	27.0 cu ft

2.5 COMPONENT STANDARDS

A. Cement shall conform to ASTM C-150, Type II

B. Fly Ash shall conform to ASTM C-618, Class F. The fly ash shall not inhibit the entrainment of air.

C. Air entrainment admixture shall conform to ASTM C-260.

D. Aggregates:
1. Fine aggregate: #1 concrete sand.
2. Course aggregate: #2 concrete sand – 3/8 pea gravel.

E. Water shall conform to California State Specifications 90-2.03.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 1 – Administrative Requirements: Coordination and project conditions.

B. Verify trench is ready to receive work.

3.2 DELIVERY TO SITE

A. Provide the Engineer/IOR with delivery tickets for each truck load that show the CLSM mix, the batch quantity and time batched.

3.3 BATCHING, MIXING AND DELIVERING

A. CLSM shall be batched at a Ready-Mix Concrete Plant and delivered to the job site by means of transit mixing trucks.

3.4 INSTALLATION

A. CLSM shall be discharged from transit mix trucks by any reasonable means into the excavation to be backfilled.

B. The CLSM shall be brought uniformly to the elevation of the:
   1. Underside of subgrade or asphalt concrete pavement.
   2. Underside of structural concrete.

3.5 FIELD QUALITY CONTROL

A. The soil testing firm shall provide testing and inspection services.

B. No equipment or traffic shall be allowed on the CLSM until the surface of the CLSM will withstand the weight of the equipment or traffic without damage or displacement.

C. To prevent damage or displacement in traffic areas, provide steel plates that will span the trench until such time as the CLSM has obtained sufficient strength to support equipment and traffic loads.

3.6 FORMING

A. Forms shall conform to the requirements of Section 51 of Caltrans Standard Specifications, July 92 edition.

END OF SECTION

SECTION 32 11 23
AGGREGATE BASE COURSE

PART 1 GENERAL

1.1 SUMMARY

A. Section includes aggregate base course.

B. Related Sections:
1. Section 31 05 13 - Soils for Earthwork.
2. Section 31 22 13 - Rough Grading.
3. Section 31 23 23.13 - Backfill.
4. Section 31 23 16.13 - Trenching.
5. Section 32 12 16 - Asphalt Pavement.
6. Section 32 13 13 - Concrete Paving.

PART 2 PRODUCTS

2.1 MATERIALS

A. Class II Aggregate Base per Caltrans Standard Specifications, or Local Municipality.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

3.2 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.

B. Do not place fill on soft, muddy, or frozen surfaces.

3.3 AGGREGATE PLACEMENT

A. Place aggregate in maximum 6-inch layers and compact to specified density.

B. Level and contour surfaces to elevations and gradients indicated.

C. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.

D. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.

E. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.4 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Flatness: Maximum variation of 1/4 inch measured with 10-foot straight edge.

C. Scheduled Compacted Thickness: Within 1/4 inch.

D. Variation From Design Elevation: Within 1/2 inch.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Testing and inspection services.

B. Compaction testing will be performed in accordance with ASTM D1557.

C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to owner.

END OF SECTION

SECTION 32 12 16
ASPHALT PAVEMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section includes asphaltic concrete paving, wearing, binder and base course; surface sealer; and aggregate base course.

B. Related Sections:
1. Section 31 05 13 - Soils for Earthwork.
2. Section 31 22 13 - Rough Grading: Preparation of site for paving and base.
3. Section 31 23 23.13 - Backfill: Compacted subbase for paving.
4. Section 32 11 23 - Aggregate Base Course.

1.2 REFERENCES

A. ASTM D946 - Penetration-Graded Asphalt Cement for Use in Pavement Construction.

B. ASTM D3381 - Viscosity Graded Asphalt Cement for Use in Pavement Construction.

C. TAI - (The Asphalt Institute) - MS-2 Mix Design Methods for Asphalt Concrete and Other Hot Mix Types.

D. TAI - (The Asphalt Institute) - MS-3 Asphalt Plant Manual.

E. TAI - (The Asphalt Institute) - MS-8 Asphalt Paving Manual.

F. TAI - (The Asphalt Institute) - MS-19 Basic Asphalt Emulsion Manual, Section 8-7.

1.3 SUBMITTALS

A. Product Data: Submit product information and mix design.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with The Asphalt Institute.

B. Mixing Plant: Conform to The Asphalt Institute.

C. Obtain materials from same source throughout.

D. Maintain one copy of each document on site.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 PRODUCTS

2.1 MATERIALS

A. Asphalt Pavement: In accordance with The Asphalt Institute.

2.2 SOURCE QUALITY CONTROL AND TESTS

A. Section 01 45 23 - Quality Control: Testing and Inspection Services: Provide mix design for asphalt.

B. Submit proposed mix design for review prior to beginning of Work.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify compacted granular base is dry and ready to support paving and imposed loads.

C. Verify gradients and elevations of base are correct.

3.2 SUBBASE

A. Section 32 11 23 - Aggregate Base Course forms the base construction for Work of this section.

3.3 PREPARATION - TACK COAT

A. Apply tack coat in accordance with The Asphalt Institute.

B. Apply tack coat to contact surfaces of curbs and gutters.

C. Coat surfaces of manhole and catch basin frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

3.4 PLACING ASPHALT PAVEMENT - SINGLE COURSE

A. Install Work in accordance with The Asphalt Institute.

3.6 PLACING FOG SEAL

3.7 CURBS

A. Install extruded asphalt curbs of profile as indicated on drawings.

3.8 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Flatness: Maximum variation of 1/4 inch measured with 10-foot straight edge.

C. Scheduled Compacted Thickness: Within 1/4 inch.

D. Variation from True Elevation: Within 1/2 inch.

3.9 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Testing and inspection services
Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

3.10 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting finished work.

B. Immediately after placement, protect pavement from mechanical injury for 24 hours or until surface temperature is less than 140 degrees F.

3.11 SCHEDULES

A. Pavement sections for various locations and uses are to be as shown on the drawings.

END OF SECTION

SECTION 32 13 13
CONCRETE PAVING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes concrete sidewalks, integral curbs, gutters, parking areas, driveways, and roads; and aggregate base course.

B. Related Sections:
1. Section 31 22 13 - Rough Grading.
2. Section 31 23 23.13 - Backfill.
3. Section 32 11 23 - Aggregate Base Course.

1.2 REFERENCES

A. ACI 304 (American Concrete Institute) - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

B. ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.

C. ASTM A497 - Welded Deformed Steel Wire Fabric for Concrete Reinforcement.

D. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement.

E. ASTM C33 - Concrete Aggregates.

F. ASTM C94 - Ready Mix Concrete.

G. ASTM C150 - Portland Cement

H. ASTM C260 - Air-Entraining Admixtures for Concrete.

I. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.

J. ASTM C494 - Chemical Admixtures for Concrete.

K. ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.

L. ASTM D1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

M. Caltrans Standard Specifications, 2010 Edition.

1.3 QUALITY ASSURANCE

A. Perform Work in accordance with requirements Caltrans Standard Specifications.

B. Maintain one copy of each document on site.

C. Obtain cementitious materials from same source throughout.

1.4 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not place concrete when base surface temperature is less than 40 degrees, or surface is wet or frozen.

PART 2 PRODUCTS

2.1 FORM MATERIALS

A. Wood or Steel form material, profiled to suit conditions.

B. Joint Filler: ASTM D1751.

2.2 REINFORCEMENT

A. Reinforcing Steel: ASTM A615; Grade 60 deformed billet steel bars; unfinished.

B. Welded Steel Wire Fabric: Plain type, ASTM A185 in flat sheets or coiled rolls; unfinished.

C. Dowels: ASTM A615; plain steel, unfinished.

2.3 CONCRETE MATERIALS

A. Concrete Materials: In accordance with Caltrans Standard Specifications.

B. Fly Ash content Caltrans Standard Specifications.

2.4 CONCRETE MIX - BY PERFORMANCE CRITERIA

A. Provide concrete to the following criteria:
1. Compressive Strength: 3000 psi @ 28 days.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify compacted subgrade or granular base is acceptable and ready to support paving and imposed loads.

C. Verify gradients and elevations of base are correct.

3.2 SUBBASE

A. Section 32 11 23 - Aggregate Base Course forms the base construction for Work of this section.

3.3 PREPARATION

A. Moisten base to minimize absorption of water from fresh concrete.

B. Coat surfaces of manhole and catch basin frames with oil to prevent bond with concrete pavement.

C. Notify Architect/Engineer minimum 24 hours prior to commencement of concreting operations.

3.4 FORMING

A. Place and secure forms to correct location, dimension, profile, and gradient.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.5 REINFORCEMENT

A. Place reinforcement as indicated on drawings.

B. Interrupt reinforcement at expansion joints.

C. Place reinforcement to achieve pavement and curb alignment as detailed.

3.6 PLACING CONCRETE

A. Place concrete in accordance with Caltrans Standard Specifications.

B. Ensure reinforcement, inserts, embedded parts, formed joints and are not disturbed during concrete placement.

C. Place concrete continuously over the full width of the panel and between predetermined construction joints.

D. Place concrete to pattern indicated on drawings.

3.7 JOINTS

A. Place expansion and contraction joints as shown on drawings. Align curb, gutter, and sidewalk joints.

B. Place joint filler between paving components and building or other appurtenances. Recess top of filler 1/4 inch for sealant placement.

C. Provide scored sawn joints as indicated on drawings and between sidewalks and curbs.

3.8 FINISHING

A. Sidewalk Paving: Light broom perpendicular to path of travel and trowel joint edges to provide a slip resistant surface.

B. Curbs and Gutters: Light broom in direction of flow.

C. Direction of Texturing: Transverse to pavement direction.

D. Inclined Vehicular Ramps: Broomed perpendicular to slope.

E. Place curing compound on exposed concrete surfaces immediately after finishing.

3.9 JOINT SEALING

A. Separate pavement from vertical surfaces with thick joint filler.

B. Place joint filler in pavement pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

C. Extend joint filler from bottom of pavement to within 1/8 inch of finished surface. Conform to joint sealer manufacturer requirements.

3.10 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation of Surface Flatness: 1/4 inch in 10 feet.

C. Maximum Variation From True Position: 1/2 inch.

3.11 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Testing and inspection services
Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Testing firm will take cylinders and perform slump [and air entrainment] tests in accordance with ACI 301.

C. One slump test will be taken for each set of test cylinders taken.

D. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.12 PROTECTION

A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

B. Do not permit pedestrian or vehicular traffic over pavement for 7days minimum after finishing.

END OF SECTION

SECTION 323113 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Chain-link fences.
2. Swing gates.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Inspect and discuss electrical roughing-in, equipment bases, and other preparatory work specified elsewhere.
2. Review coordination of interlocked equipment specified in this Section and elsewhere.
3. Review required testing, inspecting, and certifying procedures.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

a. Fence and gate posts, rails, and fittings.
b. Chain-link fabric, reinforcements, and attachments.
c. Gates and hardware.

B. Shop Drawings: For each type of fence and gate assembly.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include accessories, hardware, gate operation, and operational clearances.

C. Samples for Initial Selection: For each type of factory-applied finish.

D. Samples for Verification: For each type of component with factory-applied finish, prepared on Samples of size indicated below:

1. Polymer-coated steel wire (for fabric) in 6-inch (150-mm) lengths.
2. Polymer-Coated Components: In 6-inch (150-mm) lengths on shapes for posts, rails, wires and gate framing and on full-sized units for accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of chain-link fence, and gate, signed by product manufacturer.

B. Product Test Reports: For framework strength according to ASTM F1043, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranty: For special warranty.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed chain-link fences and gates similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Testing Agency Qualifications: For testing fence grounding; member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.7 MOCKUP

A. Build mockups to set quality standards for fabrication and installation.

1. Build mockup for typical chain-link fence and gate, including accessories.

a. Size: 10-foot (3 m) length of fence.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Gates within accessible path of travel shall conform with the requirements of CBC Section 11B-404.

B. Structural Performance: Chain-link fence and gate frameworks shall withstand the design wind loads and stresses for fence height(s) and under exposure conditions indicated according to ASCE/SEI 7.

1. Design Wind Load: As indicated on Drawings.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with the requirements, provide products by on of the following:

1. Chain-Link Fences and Gates

a. Builders Fence Company, Inc. Sacramento, CA (916) 381-4065
b. Master Halco. Hayward, CA, (800) 899-4174
c. Security Contractor Services, Inc., San Jose, CA (800) 843-7893
d. Steel and Fence Supply, San Jose, CA (408) 573-3779

2.3 CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist according to "CLFMI Product Manual" and requirements indicated below. Comply with ASTM A 392, CLFMI CLF 2445.

B. Zinc-coated fabric shall be galvanized after weaving with a minimum 1.2 ounces of zinc per square foot or surface area and conform to ASTM A392, Class 1. Fabric to be 9 gauge wire. Top and bottom selvage to be knuckled.

1. Mesh Size: 2 inches (50 mm).

C. Polymer Coating (PVC Coated): Minimum 7 mil PVC plastic resin finish. ASTM D 668, Class 2 over metallic-coated steel wire.

1. Color: As selected by Architect from manufacturer's standard color range, complying with ASTM F 934.
2. Coat selvage ends of fabric that is metallic coated before the weaving process with manufacturer's standard clear protective coating.
3. Furnish one piece fabric widths for fencing up to 12 feet high.

4. When PVC coating is specified on drawing, fabric and all exposed fence components shall also be PVC coated.

2.4 FENCE FRAMEWORK

A. Posts and Rails: ASTM F1043 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F1043 for framing and ASTM F1083 for Group IC round pipe, schedule 40 minimum, hot-dipped galvanized, based on the following:

1. Fence Height: As indicated on Drawings.
2.

End, Corner and Pull Post Height	Pipe Size
Up to 6 foot fabric height	2.375” OD steel pipe, 3.65 lbs./ lin. ft.
Over 6 and up to 8 foot fabric height	2.875” OD steel pipe, 5.79 lbs./lin. ft.
Over 8 and up to 10 foot fabric height	4.00” OD steel pipe, 9.12 lbs./lin. ft.
Over 10 and up to 12 foot fabric height	4.00” OD steel pipe, 9.12 lbs./lin. ft.

3.

Line Posts	Pipe Size
Up to 6 foot fabric height	1.90” OD steel pipe, 2.70 lbs./ lin. ft.
Over 6 and up to 8 foot fabric height	2.375” OD steel pipe, 3.65 lbs./lin. ft.
Over 8 foot up to 10 foot fabric height	2.875” OD steel pipe, 5.79 lbs./lin.ft.
Over 10 and up to 12 foot fabric height	2.875” OD steel pipe, 5.79 lbs./lin.ft.

4.

Top, Mid and Bottom Rails	Pipe Size
Up to 12 foot fabric height	1.66” OD steel pipe, 2.27 lbs./lin.ft.

5. Posts, bracing and framing for fences supporting signs, windscreens, shade cloths or anything increasing the load, shall be installed as recommended by a structural engineer for that purpose.

2.5 SWING GATES

A. Gates along an accessible POT must comply with CBC Section 11B-404.

B. General: ASTM F900 for gate posts and [single] [double] swing gate types.

1. Gate Leaf Width: As indicated.
2. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F 1043 and ASTM F 1083 for materials and protective coatings.
3. Gate Fabric Height: 2 inches less than adjacent fence height.
4. Fabric and finish: shall match adjacent fencing.

C. Swing Gate Post: Furnish posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths as follows:

1. Gate fabric height up to and including six (6) feet in height (1.2 m):

Gate Leaf Width	Gate Post Outside Diameter
Up to 4 feet (1.2 m)	2.375 inches (60.3 mm)
Over 4 feet to 10 feet (1.2 to 3.05 m)	2.875 inches (73.0 mm)
Over 10 feet to 18 feet (3.05 to 5.5 m)	4.000 inches (101.6 mm)

2. Gate fabric height over six (6) feet (1.2 m), up to and including twelve (12) feet in height:

Gate Leaf Width	Gate Post Outside Diameter
Up to 6 feet (1.8 m)	2.875 inches (73.0 mm)
Over 6 feet to 12 feet (1.8 to 3.7 m)	4.000 inches (101.6 mm)
Over 12 feet to 18 feet (3.7 to 5.5 m)	6.625 inches (168.3 mm)
Over 18 feet to 24 feet (5.5 m to 7.3 m)	8.625 inches (219.1 mm)

D. Frame Corner Construction:

E. Welded or assembled with corner fittings and rivets, and 3/8-inch diameter, adjustable truss rods for gate panels.

F. Hardware: Provide hardware and accessories for each gate, galvanized per ASTM A153, finish to match adjacent fencing, quality for commercial and industrial applications and in accordance with the following:

1. Latches for maintenance gates, fork type or plunger-bar type, permitting operation from both sides of gate, hinges, center gate stops and keepers for each gate leaf more than 5 feet wide. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate. Install concrete footing to receive drop rod in closed position. Install gate latches at a consistent height above grade throughout the campus, recommended 36” minimum and 44” maximum.
2. Latches for gates in the ADA Path of Travel: refer to Drawings for “accessible gate latch” detail. Install gate latches at a consistent height above grade throughout the campus, recommended 36” minimum and 44” maximum.
3. Kick Plate: Install on accessible path of travel gates. Fabricate 10” high by width of gate, 1/8” thickness steel, finish to match fence material.
4. Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180 degree gate opening. Provide one (1) pair of hinges for each leaf under 6’ in nominal height and one and one-half (1-1/2) pair of hinges for each leaf 6’ and over in nominal height. Adjust and maintain gate spring hinges on accessible man-gates per CBC 11B-404.2.8.2 so that from the open position of 70 degrees, the door shall move to the closed position in 1.5 seconds minimum.
5. Keeper: Provide keeper for vehicle gates, which automatically engages gate leaf and holds it open position until manually released.
6. Double Gates: Provide gate stops for double gates (one for each gate), consisting of standard drop rod with concrete footings installed to receive and secure drop rods. Install fork-type, drop latch with padlock eyes as integral part of latch, permitting both gate leaves to be locked with a single padlock.
7. Refer to Section 087111 “Door Hardware” for panic hardware.

2.6 FITTINGS

A. Provide fittings according to ASTM F626.

B. Post and Line Caps: Provide for each post.

1. Pressed steel, cast iron or cast aluminum alloy designed to fit snugly over posts to exclude moisture. Fittings to conform to ASTM F626.
2. Supply dome style caps for terminal posts.

3. Supply post caps with loop to receive tension wire or top rail on line posts.

C. Rail and Brace Ends: Pressed steel, cast iron or cast alloy, cup shaped to receive rail brace ends.

D. Rail Fittings: Provide the following:

1. Top Rail Sleeves: Pressed-steel or round-steel tubing 0.051 thickness by 7 inches long, expansion type.
2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate and bottom rails to posts.

E. Tension and Brace Bands: Pressed steel, 12 gauge thickness by 3/4 inch wide.

F. Tension Bars: Steel, length not less than 2 inches (50 mm) shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post. Bars shall be 3/4 inch wide by 3/16 inch thick.

G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.

H. Tie Wires, Clips, and Fasteners: According to ASTM F626.

1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, according to the following:

a. Hot-Dip Galvanized Steel: 0.148-inch- (3.76-mm-) diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.

I. Finish:

1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz./sq. ft. (366 g/sq. m) of zinc.

a. Polymer coating over metallic coating.

2.7 CAST-IN-PLACE CONCRETE

A. Materials: Portland cement complying with ASTM C 150, Type I aggregates complying with ASTM C 33, and potable water. Measure, batch, and mix Project-site-mixed concrete according to ASTM C 94/C 94M.

1. Concrete Mixes: Normal-weight concrete, 2% to 4% air entrained with not less than 3000-psi compressive strength (28 days), 3-inch slump, and 1-inch maximum size aggregate.

B. Materials: Dry-packaged concrete mix complying with ASTM C 387 for normal-weight concrete mixed with potable water according to manufacturer's written instructions.

2.8 POLYMER FINISHES

A. Supplemental Color Coating: In addition to specified metallic coatings for steel, provide fence components with polymer coating.

B. Metallic-Coated Steel Tension Wire: PVC-coated wire complying with ASTM F 1664, Class 2b.

C. Metallic-Coated Steel Framing and Fittings: Comply with ASTM F 626 and ASTM F 1043 for polymer coating applied to exterior surfaces and, except inside cap shapes, to exposed interior surfaces.

1. Polymer Coating: Not less than 10-mil- thick PVC finish.

D. Color: As selected by Architect from manufacturer's full range, complying with ASTM F 934.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for a certified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet (152 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 INSTALLATION - GENERAL

A. Install chain-link fencing according to ASTM F567 and more stringent requirements specified.

1. Install fencing on established boundary lines inside property line.

3.4 CHAIN-LINK FENCE INSTALLATION

A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated and not more than ten 10 feet, in firm, undisturbed soil.

1. If diameter is not indicated, excavate holes for line and end posts to twelve (12) inches minimum width. If depth is not indicated, excavate holes for line and end posts to not less than 24" minimum plus an additional 3" for each 12" over 4' fence height. Gate posts shall be larger and as required to support heavy lateral loads. Trowel finish surface and slope to drain away from posts and flush with finish grade.

B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Extend concrete 2 inches above grade; shape and smooth to shed water. Protect aboveground portion of posts from concrete splatter.
3. Center and align posts in holes 3 inches above bottom of excavation.

C. Terminal Posts: Install terminal end, corner, and gate posts according to ASTM F567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more. For runs exceeding 500 feet (152 m), space pull posts an equal distance between corner or end posts.

D. Line Posts: Space line posts uniformly at 10 feet (3 m) o.c.

E. Post Tops: Provide weather tight closure cap with loop to receive top rail. One cap for each post.

F. Post Bracing and Intermediate Rails: Install according to ASTM F567, maintaining plumb position and alignment of fence posts. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.

1. Locate horizontal braces at midheight of fabric 72 inches (1830 mm) or higher, on fences with top rail, and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

G. Tension Wire: Install according to ASTM F567, maintaining plumb position and alignment of fence posts. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- (3.05-mm-) diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches (610 mm) o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:

1. Top Tension Wire: Install tension wire through post cap loops.
2. Bottom Tension Wire: Install tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.

H. Top Rail: Install according to ASTM F567, maintaining plumb position and alignment of fence posts. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

I. Intermediate and Bottom Rails: Install as indicated on drawing in same fashion as top rail installation, spanning between posts. Install tension wire if bottom rail is not called for on drawing.

J. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2-inch (50-mm) bottom clearance between finish grade or surface and bottom selvage (except at Tennis Courts, which shall be 1 inch) unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

K. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches o.c. At gates, install fabric with stretcher bars at vertical edges and top and bottom edges. Attach stretcher bars to gate frame at not more than 15 inches o.c.

L. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric according to ASTM F626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts at 12 inches (300 mm) o.c. and to braces at 24 inches (610 mm) o.c.

M. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

N. Privacy Slats: Install slats in direction indicated, securely locked in place.

3.5 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation.

B. Install kick-plate on bottom of gate as shown on details, weld ends to gate frame at 8” o.c. spacing, finish to match fencing material.

3.6 CANTILEVER FENCE SECTIONS

A. If Contractor elects to install cantilever fence sections where support posts cannot be installed immediately adjacent to a structure:

1. Cantilever section shall terminate 1-1/2” from adjacent structure.
2. Cantilever section shall not extend more than 30” from center of post to adjacent structure.
3. Cantilever section shall be securely welded to nearest post to prevent rotational movement around nearest post.

3.7 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION 323113

SECTION 33 40 00
STORM DRAINAGE UTILITIES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes gravity site storm sewerage drainage piping, fittings and accessories, and bedding; bio-retention facilities connection of drainage system to municipal sewers and on-site points of connection; and catch basins, area drains, and cleanouts.

B. Related Sections:
1. Section 31 05 13 - Soils for Earthwork.
2. Section 31 23 00 - Excavation.
3. Section 31 23 16.13 - Trenching.
4. Section 31 23 23.13 - Backfill.
5. Section 33 30 00 - Sanitary Sewerage Utilities.

1.2 REFERENCES

A. AASHTO M36 (American Association of State Highway and Transportation Officials) - Metallic (Zinc or Aluminum) Coated Corrugated Steel Culverts and Underdrains.

B. ASTM A74 - Cast Iron Soil Pipe and Fittings.

C. ASTM C14 - Concrete Sewer, Storm Drain, and Culvert Pipe.

D. ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

E. ASTM C425 - Compression Joints for Vitrified Clay Pipe and Fittings.

F. ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

G. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

H. ASTM D2729 - Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

I. ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.

J. ASTM D3033 - Type PSP Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

K. ASTM D3034 - Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

L. ASTM D7613 – Polypropylene Liner.

M. Class II Permeable Materials – To meet the requirements of Caltrans Standard Specification 68-1.025.

N. ASTM D6707 – Mirafi Filter Fabric.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data indicating pipe, pipe accessories, and fittings.

C. Manufacturer's Installation Instructions: Submit special procedures required to install Products specified.

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

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Project Record Documents:
1. Accurately record actual locations of pipe runs, connections, catch basins, cleanouts, and invert elevations.
2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

C. Operation and Maintenance Data: Procedures for submittals.

1.5 COORDINATION

A. Section 01 50 00 - Temporary Facilities and Controls.

B. Coordinate the Work with termination of storm sewer connection outside building, trenching, connection to foundation drainage system, municipal sewer utility service, and on-site points of connection.

PART 2 PRODUCTS

2.1 MATERIALS

A. Sewer Pipe Materials:

1. Cast Iron Pipe: ASTM A74, Service type, inside nominal diameter of 4 to 12 inches, bell and spigot end.

2. Cast Iron Pipe Joint Device: ASTM C564, rubber gasket joint devices.

3. Concrete Pipe: ASTM C14, Class 3; unreinforced; inside nominal diameter of 10 inches, bell and spigot end joints.

4. Concrete Pipe Joint Devices: ASTM C443, rubber compression gasket joint.

5. Reinforced Concrete Pipe: ASTM C76, Class III or IV; inside nominal diameter of 12 to 60 inches, bell and spigot end joints.

6. Reinforced Concrete Pipe Joint Device: ASTM C443, rubber compression gasket joint.

7. Plastic Pipe: ASTM D2751, SDR 26, Acrylonitrile-Butadiene-Styrene (ABS) material; inside nominal diameter of 4 to 24 inches, bell and spigot style solvent sealed joint end.

8. Plastic Pipe: ASTM D3034, Type PSM, Poly(Vinyl Chloride) (PVC) SDR-26 material; inside nominal diameter of 4 to 24 inches, bell and spigot style rubber ring sealed gasket joint.

9. Corrugated Steel Pipe: AASHTO M36; nominal diameter of 12 to 60 inches, end joints; helical lock seam; coated inside and out with 0.050 inch thick bituminous coating.

10. Corrugated Steel Pipe Coupling Bands: Galvanized steel, 0.052 inches thick x 10 inches wide; connected with two neoprene "O" ring gaskets and two galvanized steel bolts.

11. Perforated Plastic Pipe: ASTM D3034, PVC with perforations.

B. Liner:

1. 30 mil polypropylene liner.

2.2 ACCESSORIES

A. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

B. Grout: Non shrink, high strength, cement based grout.

2.3 CATCH BASINS AND PLANT AREA DRAINS

A. NEW - As specified on the drawings.

B. EXISTING – Adjust as specified on the drawings. For inlets in pedestrian areas, ensure grates are ADA compliant. Replace non-compliant grates as necessary.

2.4 CLEANOUTS

A. As specified on the drawings.

2.5 BEDDING AND COVER MATERIALS

A. Bedding: Fill as specified by pipe manufacturer and approved by Soils Engineer.

B. Cover: Fill as specified in the project Soils Report and any supplements to the Soils Report.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on drawings.

3.2 PREPARATION

A. Hand trim excavations to required elevations. Correct over excavation with bedding material.

B. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

3.3 BEDDING

A. Excavate pipe trench in accordance with Section 31 23 16.13 for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.

B. Place bedding material at trench bottom, level materials in continuous layer not exceeding 6 inches compacted depth.

C. Maintain optimum moisture content of bedding material to attain required compaction density.

3.4 INSTALLATION - PIPE

A. Install pipe, fittings, and accessories in accordance with ASTM D2321. Seal joints watertight.

B. Lay pipe to slope gradients noted on drawings with maximum variation from true slope of 1/8 inch in 10 feet.

C. Perforated pipe shall be installed with perforations down.

D. Install trench fill at sides and over top of pipe. Provide top cover to minimum compacted thickness of 12 inches, compact to 95 percent.

E. Refer to Section 31 23 23.13 for backfilling and compacting requirements. Do not displace or damage pipe when compacting.

3.5 INSTALLATION - CATCH BASINS AND CLEANOUTS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place Cast-In-Place Concrete base pad, with provision for storm sewer pipe end sections.

C. Level top surface of base pad; sleeve concrete shaft sections to receive storm sewer pipe sections.

D. Establish elevations and pipe inverts for inlets and outlets as indicated.

E. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.6 INSTALLATION – BIO-RETENTION FACILITIES

A. Form bottom of excavation smooth to correct elevation.

B. Install welded seam 30 mil polypropylene liner in basin bottom.

C. Install Class II permeable material minimum 2” under perforated pipe.

D. Install remainder of Class II permeable material.

E. Install Mirafi Filber Fabric over permeable materials.

F. Install top soil.

3.7 FIELD QUALITY CONTROL

A. Section 01 45 23 - Quality Requirements: Testing and inspection services.

B. Request inspection prior to and immediately after placing aggregate cover over pipe.

C. Compaction testing will be performed in accordance with ASTM D1557.

D. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to owner.

3.8 INSTALLATION, FLUSHING & CLEANING

A. All new pipe installed and existing pipe connected to shall be flushed, cleaned and videoed for at least 200 feet downstream, or to the next downstream inlet or manhole, whichever is farther, of last point of connection to ensure clean and functioning system.

3.9 PROTECTION OF FINISHED WORK

A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.
   1. Take care not to damage or displace installed pipe and joints during construction of pipe supports, backfilling, testing, and other operations.
   2. Where pipe is damaged or displaced, take remedial measures as directed by the Architect/Engineer including, but not limited to, retesting of joints, relaying pipe or replacing pipe. Provide remedial measures at no additional cost to the Owner.

END OF SECTION