

BGWARCHITECTS

PROJECT MANUAL

for

**University Federal Credit Union
DRAPER BRANCH**

811 East 12300 South
Draper, UT 84020



April 29th, 2020

BGW Architects, L.L.C
2909 Washington Blvd,
Ogden, UT 84401
P: 801-618-3463 F: 801-622-8142

PROJECT MANUAL
UNIVERSITY FEDERAL CREDIT UNION
DRAPER BRANCH
811 EAST 12300 SOUTH
DRAPER, UT 84020

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NOTICE TO CONTRACTORS

Sealed bids will be received by BGW Architects for:

University Federal Credit Union – Draper Branch

811 East 12300 South

Draper, UT 84020

Bids will be in accordance with the Contract Documents (referred to hereinafter as “Contract Documents”) prepared and distributed by: BGW Architects
2909 Washington Blvd, Ogden, UT 84401 (hereinafter referred to as “Architect” as defined in the General Conditions) upon receipt of \$ 100.00 deposit per printed set, made payable to BGW Architects.

Prior to any bidder receiving Drawings or Specifications, it will be necessary that the person or company bidding have on file with the BGW Architects a copy of their current Utah contractor’s license covering the type of work to be done and a statement from their Surety Company evidencing bond ability to the amount of the Contract.

Bids will be received until the hour of 4:00pm - August 20th, 2020

Email bids to jwetendorf@bgwservices.com.

University Federal Credit Union reserves the right to reject any or all bids or to waive any formality or technicality in any bid in the interest of the Owner.

INSTRUCTIONS TO BIDDERS

1. Drawings and Specifications, Other Contract Documents

Schematic Drawings and Specifications, as well as other available Contract Documents, may be obtained from: BGW Architects, 2909 Washington Blvd, Ogden, UT 84401 - Owner's Architect Representative, hereinafter referred to as "Architect" for the deposit stated in the Notice to Contractors.

Any person or firm that fails to return the complete printed set of Drawings and Specifications, or other Contract Documents, in good conditions within ten (10) days after the time set for receiving bids, will forfeit the cost of printed drawings.

2. Proposals

Before submitting a Proposal, each bidder shall carefully examine the Contract Documents; shall visit the site of the Work; shall fully inform themselves as to all existing conditions and limitations; and shall include in the Proposal the cost of all items required by the Contract Documents. If the bidder observes that portions of the Contract Documents are at variance with applicable laws, building codes, rules, regulations or contain obvious erroneous or uncoordinated information, the bidder shall promptly notify the Architect and the necessary changes shall be accomplished by Addendum.

The Proposal, bearing original signatures, must be typed or handwritten in ink on the Proposal form and submitted in a sealed envelope at the location specified by the Notice to Contractor's prior to the time designated for the opening of bids.

3. Contract and Bond

The Contractor's Agreement will be in the form bound in the Project Manual. The Contract Time will be as indicated in the Proposal. The successful bidder, simultaneously with the execution of the Contract Agreement, will be required to furnish a performance bond and a payment bond, both bearing original signatures, upon the forms provided along with the Specifications. The performance and payments bonds shall be for an amount equal to one hundred percent (100%) of the Contract Sum and secured from a company that meets the requirements specified in the requisite forms.

4. Listing of Subcontractors, Suppliers & Vendors

Listing of Subcontractors shall be as required within 24 hours of accepted bids.

Such list shall be binding upon the Contractor; however, Owner has a right to reject any or all Subcontractors, suppliers and vendors listed or unlisted which Owner and/or Architect feels is unqualified to do the Work or for other reasons in the best interest of the Owner.

Owner may withhold awarding the contract to a particular bidder if one or more of the proposed Subcontractors, suppliers and vendors are considered by the Owner to be unqualified to do the Work or for other reason in the best interest of the Credit Union.

Copies of all bids or other proposals from Subcontractors and Sub-subcontractors shall, upon request of the Owner, be submitted to the Owner for review.

Any bonding requirements for Subcontractors will be specified in the Supplementary General Conditions.

5. Bid Alternates

Contractor to provide base bid and alternates as listed on 'Bid Proposal Form'

BID PROPOSAL FORM

CONTRACTOR: _____

CONTRACTOR UTAH LICENCE #: _____

ADDRESS: _____

DATE: _____

OWNER:
University Federal Credit Union
3450 Highland Ave.
Salt Lake City, UT 84106

The undersigned, responsive to the “Notice to Contractors” and in accordance with the “Instructions to Bidders” in compliance with your invitation for bids for the:

University Federal Credit Union – Draper Branch Remodel
811 East 12300 South, Draper, UT 84020

And having examined the Contract Documents and the site of the proposed Work and being familiar with all of the conditions surrounding the construction of the proposed Project, including the availability of labor, hereby proposes to furnish all labor, materials and supplies as required for the Work in accordance with the Contract Documents as specified and within the time set forth and at the price stated below. This price is to cover all expenses incurred in performing the Work required under the Contract Documents of which this Proposal is a part:

I/We acknowledge receipt of the following Addenda: _____

(If no Addenda received enter “NONE”)

Base Bid: For all work shown on the Drawings and described in the Specification and Contract Documents, I/We agree to perform for the sum of:

_____ DOLLARS (\$ _____)

(In case of discrepancy, written amount shall govern)

Bid Alternates:

(1) Slurry seal remaining existing asphalt, I/We agree to perform for the sum of: _____

(2) Remove & replace all remaining existing asphalt, I/We agree to perform for the sum of: _____

I/We guarantee that the Work will be Substantially Complete within 120 (to be filled in by Architect) calendar days after receipt of the Notice to Proceed or upon receiving the building permit should I/We be the successful bidder. This bid shall be good for 60 days after bid opening.

Enclosed is _____, as required (bid bond), in the sum of NONE REQUIRED.
(Bond or Check)

IN TESTIMONY WHEREOF, the Bidder, a sole proprietorship, has hereunto set his hand this
___ day of ____.

Name of Business

BY:

IN TESTIMONY WHEREOF, the Bidder, a partnership, has hereunto set his hand this
___ day of ____.

Name of Partnership

BY: _____
Managing General Partner

IN TESTIMONY WHEREOF, the Bidder, a corporation, has hereunto set his hand this
___ day of ____.

Name of Corporation

BY: _____
President

ATTEST:

BY: _____
Secretary

**Finish List for
University Federal Credit Union
Draper Branch
April 29, 2020**

EXTERIOR:

- EIFS Color: Main color: Senergy "Parchment" #342 "Sahara" Finish

INTERIOR:

- Lobby Floor Tile: Marazzi Treverkchic Francese 6"x48"
- Lobby Tile Grout: Custom 186 Khaki (Home Depot Brand)
- Restroom Wall Tile: Daltilo: Beat BL03, 12x24
Daltilo: Endeavors – F164 Neo Classic (5/8" random mosaic) w/ Color Wave Glass Tile – CW302121P Red Hot (2x12) see A404.
Grout color: Custom 542 Greystone (Home Depot brand)
- Restroom Floor Tile: Marazzi Stormy Sky MD09, 12x24
Grout color: Mapei Flexcolor CQ 19 Pearl Grey
- Break Room Floor: Marazzi Tile: Treverk Chic – Francese – 6x48 Plank
Custom 186 Khaki (Home Depot Brand)
- Schluter Trim: Brushed Stainless Steel
- Carpet: Shaw: Style – Visible Tile, Color – Beam
- Walkoff System: Milliken: Obex Entrance Flooring, Grid CutX 11mm closed
Color – Grey
- Teller Pod Top/Side Surface: Corian Quartz – Slate Geo
- Teller Pod Front Surface: Wilsonart P-Laminate – Designer White
- Teller Pod Front High Center: Wilsonart P-Laminate – Regimental Red (without texture)
- Teller Pod Back Surfaces: Wilsonart P-Laminate – Black
- Millwork Top Surface: Corian Quartz – Snow White
- Millwork Vertical Surface: Wilsonart P-Laminate – Boardwalk Oak (Vertical Grain)

* Note: All floor and wall tile to have epoxy grout

INTERIOR WOOD:

- Wood Trim: Solid Maple with clear finish – vfy w/ owner
- Wood Door: Sliced White Maple Clear finish – vfy w/ owner

INTERIOR PAINT:

- Painted Walls: G.C. to coordinate with owner & architect on location
- Field Color: Sherwin Williams – Perfect Greige – Eggshell
- Accent Color #1: Benjamin Moore – White Heron - Eggshell
- Accent Color #2: Benjamin Moore – Raspberry Truffle - Eggshell
- Accent Color #3: Benjamin Moore - Metropolitan – Eggshell

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SECTION 010100 - SUMMARY OF WORK

1.1 GENERAL

- A. This project is a tenant improvement project in an existing 3,302 s.f. commercial building at address listed below as shown on Construction Documents prepared by BGW Architects, LLC. Interior work will consist of demolition, misc. casework and cabinetry, gypsum bd. wall assemblies with wood framing, ceramic tile flooring, painting, acoustical ceiling system, HVAC, and electrical. Exterior work will be limited to the addition of one storefront window system, added stucco over existing exterior wall tile, new canopy islands and columns and new site work as noted on the civil and site plans. See Owner provided services and equipment under separate contract, below.
1. Project Location: 811 East 12300 South, Draper, UT 84020
 2. Owner: University Credit Union, 3450 S Highland Ave, Salt Lake City, UT 84106
- B. Contract Documents, dated April 29th, 2020, were prepared for the Project by BGW Architects; 2909 Washington Blvd, Ogden, UT 84401.
- C. The Work will be constructed under a single prime contract.
- D. Separate Contract: The Owner has awarded (or will award) a separate contract for construction operations that will be conducted simultaneously with work under this Contract. That Contract includes the following:
1. Contract: A separate contract will be awarded to bank equipment manufacturer for teller equipment, cash machines, night deposit.
 2. Contract: A separate contract will be awarded for office system furniture, public seating, and vinyl wall covering (material only).
 3. Contract: A separate contract will be awarded for exterior signage work including install.
- E. Cooperate with separate contractors so that work under those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.
- F. The Work will be conducted in three (3) phases. The first phase is to include the new parking lot work. The other two phases and their schedules shall be coordinated with owner and architect before commencement of work.
- G. Contractor Use of Premises: During construction the Contractor shall have partial use of premises, including use of the site but shall not use any parking stalls on the east side of the building. The Contractor's use of premises is also limited by the Owner's right to perform work or employ other contractors on portions of the Project.
- H. Use of the Site: Contractor has partial use of site. Contractor to coordinate limitations with owner.
- I. Partial Owner Occupancy: The Owner reserves the right to occupy and to place and install equipment in completed areas of the building prior to Substantial Completion. Placing equipment and partial occupancy do not constitute acceptance of the Work.
1. The Architect will prepare a Certificate of Substantial Completion prior to Owner occupancy.
 2. Obtain a Certificate of Occupancy from building officials prior to Owner occupancy.

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3. Mechanical and electrical systems shall be operational and required inspections and tests completed prior to partial Owner occupancy. Upon occupancy, the Owner will operate and maintain systems serving occupied portions of the building.
4. The Owner will be responsible for maintenance and custodial service for occupied portions of the building.

J. Owner-Furnished Products: The Owner furnishes banking equipment, exterior signage & marketing boards/TV systems. The Work includes providing support systems to receive Owner's equipment, and mechanical and electrical connections.

1. The Owner will arrange for and deliver shop drawings, product data, and samples to the Contractor.
2. The Owner will arrange and pay for delivery according to the Contractor's Construction Schedule.
3. The Owner will inspect items delivered for damage.
4. If items are damaged, defective, or missing, the Owner will arrange for replacement.
5. The Owner will arrange for field services and for the delivery of warranties to the Contractor.
6. The Contractor shall designate delivery dates in the Contractor's Construction Schedule.
7. The Contractor shall review shop drawings, product data, and samples and return them noting discrepancies or problems anticipated in using the product.
8. The Contractor is responsible for receiving, unloading, and handling Owner-furnished items at the site.
9. The Contractor is responsible for protecting items from damage, including exposure to the elements. The Contractor shall repair or replace items damaged as a result of his operations.

1.2 PRODUCTS (Not Applicable)

1.3 EXECUTION

END OF SECTION 010100

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SECTION 010200 – CONTRACTOR'S PROFIT AND OVERHEAD

1.1 GENERAL

- A. General Contractor's and Sub-Contractor's profit and overhead shall be limited on any Change Order to – 10% each.

END OF SECTION 010200

SECTION 010270 - APPLICATIONS FOR PAYMENT

1.1 GENERAL

- A. Coordinate the Schedule of Values and Applications for Payment with the Contractor's Construction Schedule, Submittal Schedule, and List of Subcontracts.
- B. Schedule of Values: Coordinate preparation of the Schedule of Values with preparation of the Contractor's Construction Schedule.
 - 1. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
 - a. Contractor's Construction Schedule.
 - b. Application for Payment forms, including Continuation Sheets.
 - c. List of subcontractors.
 - d. List of products.
 - e. List of principal suppliers and fabricators.
 - f. Schedule of submittals.
 - 2. Submit the Schedule of Values at the earliest possible date but no later than 7 days before the date scheduled for submittal of the initial Applications for Payment.
- C. Format and Content: Use the Project Manual table of contents as a guide to establish the format for the Schedule of Values. Provide at least one line item for each Specification Section.
 - 1. Include the following Project identification:
 - a. Project name and location.
 - b. Name of Architect.
 - c. Project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 - 2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value.
 - h. Percentage of Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
 - 3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate evaluation of Applications for Payment. Break subcontract amounts down into several line items. Round amounts to nearest whole dollar; the total shall equal the Contract Sum.
 - 4. Provide a separate line item for each part of the Work where Applications for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed.

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5. Provide separate line items for initial cost of the materials, for each subsequent stage of completion, and for total installed value.
 6. Show line items for indirect costs and margins on costs only when such items are listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete. Include the total cost and proportionate share of general overhead and profit margin for each item.
 - a. Temporary facilities and items that are not direct cost of work-in-place may be shown as separate line items or distributed as general overhead expense.
 7. Update and resubmit the Schedule of Values when Change Orders or Construction Change Directives change the Contract Sum.
- D. Applications for Payment shall be consistent with previous applications and payments as certified by the Architect and paid for by the Owner.
- E. Payment-Application Times: Payment dates are indicated in the Agreement. The period covered by each application is the period indicated in the Agreement.
- F. Payment-Application Forms: Use AIA Document G702 and Continuation Sheets G703 as the form for Applications for Payment.
- G. Application Preparation: Complete every entry, including notarization and execution by a person authorized to sign on behalf of the Contractor. The Architect will return incomplete applications without action.
1. Entries shall match data on the Schedule of Values and the Contractor's Construction Schedule. Use updated schedules if revisions were made.
 2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.
- H. Transmittal: Submit 3 executed original copies of each Application for Payment to the Architect within 24 hours. One copy shall be complete, including waivers of lien and similar attachments.
1. Transmit each copy with a transmittal listing attachments and recording appropriate information related to the application.
- I. Waivers of Mechanics Lien: With each Application for Payment, submit waivers of lien from every entity who may file a lien arising out of the Contract and related to the Work covered by the payment.
1. Submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.
 2. When an application shows completion of an item, submit final or full waivers.
 3. Submit each Application for Payment with Contractor's waiver of lien for the period of construction covered by the application.
 - a. Submit final Applications for Payment with final waivers from every entity involved with performance of the Work covered by the application who may file a lien.
 4. Waiver Forms: Submit waivers of lien on forms, and executed in a manner, acceptable to the Owner.
- J. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include the following:

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1. List of subcontractors.
2. List of principal suppliers and fabricators.
3. Schedule of Values.
4. Contractor's Construction Schedule (preliminary if not final).
5. Submittal Schedule (preliminary if not final).
6. List of Contractor's staff assignments.
7. Copies of building permits.
8. Copies of licenses from governing authorities.
9. Certificates of insurance and insurance policies.
10. Performance and payment bonds.

K. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

1. Administrative actions and submittals that shall precede or coincide with this application include the following:
 - a. Occupancy permits.
 - b. Warranties and maintenance agreements.
 - c. Test/adjust/balance records.
 - d. Maintenance instructions.
 - e. Meter readings.
 - f. Changeover information related to Owner's occupancy.
 - g. Final cleaning.
 - h. Application for reduction of retainage and consent of surety.

L. Final Payment Application: Administrative actions and submittals that must precede or coincide with submittal of the final Application for Payment include the following:

1. Completion of Project closeout requirements.
2. Completion of items specified for completion after Substantial Completion.
3. Transmittal of Project construction records to the Owner.
4. Certified property survey.
5. Proof that taxes, fees, and similar obligations were paid.
6. Removal of temporary facilities and services.
7. Change of door locks to Owner's access.

1.2 PRODUCTS (Not Applicable)

1.3 EXECUTION (Not Applicable)

END OF SECTION 010270

SECTION 010350 - MODIFICATION PROCEDURES

1.1 GENERAL

- A. Minor Changes in the Work: The Architect will issue instructions authorizing minor changes in the Work on AIA Form G710.
- B. Owner-Initiated Change Order Proposal Requests: The Architect will issue a description of proposed changes in the Work that require adjustment to the Contract Sum or Time. The description may include supplemental or revised Drawings and Specifications.
 - 1. Proposal requests are for information only. Do not consider them an instruction to stop work or to execute the proposed change.
 - 2. Within 20 days of receipt, submit an estimate of cost necessary to execute the change for the Owner's review.
 - a. Include an itemized list of products required and unit costs, with the total amount of purchases.
 - b. Indicate taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Indicate the effect the change will have on the Contract Time.
- C. Contractor-Initiated Proposals: When unforeseen conditions require modifications, the Contractor may submit a request for a change to the Architect.
 - 1. Describe the proposed change. Indicate reasons for the change and the effect of the change on the Contract Sum and Time.
 - 2. Include an itemized list of products required and unit costs, with the total amount of purchases.
 - 3. Indicate taxes, delivery charges, equipment rental, and amounts of trade discounts.
- D. Proposal Request Form: Use AIA Document G709.
- E. Allowance Adjustment: Base Change Order Proposals on the difference between the purchase amount and the allowance, multiplied by the measurement of work-in-place. Allow for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
 - 1. Include installation costs only where indicated as part of the allowance.
 - 2. Prepare explanations and documentation to substantiate margins claimed.
 - 3. Submit substantiation of a change in work claimed in the Change Orders related to unit-cost allowances.
- F. Submit claims for increased costs because of a change in the allowance, whether for purchase order amount or handling, labor, installation, overhead, and profit. Submit claims within 21 days of receipt of authorization to proceed. The Owner will reject claims submitted later than 21 days.
 - 1. Do not include indirect expense in cost amount unless the Work has changed from that described in Contract Documents.
 - 2. No change to indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

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- G. Construction Change Directive: When Owner and Contractor disagree on the terms of a Proposal Request, the Architect may issue a Construction Change Directive on AIA Form G714 instructing the Contractor to proceed with a change.
 - 1. The Construction Change Directive contains a description of the change and designates the method to be followed to determine change in the Contract Sum or Time.
- H. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 - 1. After completing the change, submit an itemized account and supporting data to substantiate Contract adjustments.
- I. Change Order Procedures: Upon the Owner's approval of a Proposal Request, the Architect will issue a Change Order on AIA Form G701.

1.2 PRODUCTS (Not Applicable)

1.3 EXECUTION (Not Applicable)

END OF SECTION 010350

SECTION 010400 - COORDINATION

1.1 GENERAL

- A. This Section includes requirements for coordinating construction operations including, but not necessarily limited to, the following:
 - 1. Coordination drawings.
 - 2. Administrative and supervisory personnel.
 - 3. Cleaning and protection.

1.2 COORDINATION

- A. Coordinate construction to assure efficient and orderly installation of each part of the Work. Coordinate operations that depend on each other for proper installation, connection, and operation.
 - 1. Schedule operations in the sequence required to obtain the best results where installation of one part depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components to assure maximum accessibility for maintenance, service, and repair.
 - 3. Make provisions to accommodate items scheduled for later installation.
- B. Where necessary, prepare memoranda for distribution to each party involved, outlining procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
 - 1. Prepare similar memoranda for the Owner and separate contractors where coordination of their work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required procedures with other activities to avoid conflicts and assure orderly progress. Such activities include, but are not limited to, the following:
 - 1. Preparation of schedules.
 - 2. Delivery and processing of submittals.
 - 3. Progress meetings.
 - 4. Project closeout activities.
- D. Conservation: Coordinate construction to assure that operations are carried out with consideration for conservation of energy, water, and materials.
 - 1. Salvage materials and equipment involved in performance of, but not incorporated in, the Work.
- E. Coordination Drawings: Prepare coordination drawings if needed for installation of products and materials fabricated by separate entities. Prepare coordination drawings where limited space necessitates maximum utilization of space for efficient installation of different components.
 - 1. Show the relationship of components shown on separate shop drawings.

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2. Indicate required installation sequences.
3. Comply with requirements contained in Section "Submittals."

F. Staff Names: Within 15 days of commencement of construction, submit a list of the Contractor's staff assignments, including the superintendent and other personnel at the Project Site. Identify individuals and their responsibilities. List their addresses and telephone numbers.

1. Post copies in the Project meeting room, the temporary field office, and each temporary telephone.

1.3 PRODUCTS (Not Applicable)

1.4 EXECUTION

- A. Inspection of Conditions: Require Installers of major components to inspect substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected.
- B. Coordinate temporary enclosures with inspections and tests to minimize the need to uncover completed construction.
- C. Clean and protect construction in progress and adjoining materials, during handling and installation. Apply protective covering to assure protection from damage.
- D. Clean and maintain completed construction as necessary through the construction period. Adjust and lubricate operable components to assure operability without damaging effects.
- E. Limiting Exposures: Supervise construction to assure that no part is subject to harmful, dangerous, or damaging exposure. Such exposures include, but are not limited to, the following:
 1. Excessive static or dynamic loading.
 2. Excessive internal or external pressures.
 3. Excessively high or low temperatures.
 4. Water or ice.
 5. Solvents and chemicals.
 6. Abrasion.
 7. Soiling, staining, and corrosion.
 8. Combustion.

END OF SECTION 010400

SECTION 010450 - CUTTING AND PATCHING

1.1 GENERAL

- A. Cutting and Patching Proposal: Submit a proposal describing procedures in advance of the time cutting and patching will be performed. Request approval to proceed. Include the following:
1. Describe extent of cutting and patching. Show how it will be performed and indicate why it cannot be avoided.
 2. Describe changes to existing construction. Include changes to structural elements and operating components and changes in the building's appearance and other significant visual elements.
 3. List products to be used and firms that will perform Work.
 4. Indicate dates when cutting and patching will be performed.
 5. Utilities: List utilities that will be disturbed or relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.
 6. Where cutting and patching involves adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with the original structure.
 7. Approval to proceed does not waive the Architect's right to later require complete removal and replacement of unsatisfactory work.
- B. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would change their load-carrying capacity or load-deflection ratio.
1. Obtain approval before cutting and patching the following structural elements:
 - a. Foundation construction.
 - b. Bearing and retaining walls.
 - c. Timber and primary wood framing.
- C. Operational Limitations: Do not cut and patch operating elements in a manner that would reduce their capacity to perform as intended. Do not cut and patch operating elements in a manner that would increase maintenance or decrease operational life or safety.
1. Obtain approval before cutting and patching the following operating elements or safety related systems:
 - a. Primary operational systems and equipment.
 - b. Fire protection systems.
 - c. Electrical wiring systems.
- D. Visual Requirements: Do not cut and patch exposed construction in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities. Do not cut and patch in a manner that would result in visual evidence of cutting and patching. Remove and replace construction cut and patched in a visually unsatisfactory manner.
1. Retain the original Installer to cut and patch the exposed Work listed below. If it is impossible to engage the original Installer, engage a recognized experienced and specialized firm.

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- E. Existing Warranties: Replace, patch, and repair material and surfaces cut or damaged in such a manner as not to void warranties.

1.2 PRODUCTS

- A. Use materials identical to existing materials. Use materials that visually match adjacent surfaces to the fullest extent possible if identical materials are unavailable. Use materials whose performance will equal that of existing materials.

1.3 EXECUTION

- A. Examine surfaces to be cut and patched and conditions under which work is to be performed before cutting. If unsafe or unsatisfactory conditions are encountered, take corrective action.
 - 1. Before proceeding, meet with parties involved. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.
- B. Temporary Support: Provide temporary support of work to be cut.
- C. Protection: Protect existing construction to prevent damage. Provide protection from adverse weather conditions for portions that might be exposed during cutting and patching operations.
- D. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- E. Avoid cutting pipe, conduit, or ductwork serving the building but scheduled to be removed or relocated until provisions have been made to bypass them.
- F. Performance: Employ skilled workmen. Proceed at the earliest feasible time and complete without delay.
 - 1. Cut construction to install other components or perform other construction and subsequent fitting and patching required to restore surfaces to their original condition.
- G. Cutting: Cut using methods that will not damage elements retained or adjoining construction. Comply with the original Installer's recommendations.
 - 1. Use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. To avoid marring finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Cut through concrete and masonry using a cutting machine, such as a Carborundum saw or a diamond-core drill.
 - 4. Comply with requirements of applicable Division 2 Sections where cutting and patching requires excavating and backfilling.
 - 5. Where services are required to be removed, relocated, or abandoned, by-pass utility services before cutting. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.
- H. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.

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1. Inspect and test patched areas to demonstrate integrity of the installation.
 2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 3. Where removing walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform color and appearance. Remove floor and wall coverings and replace with new materials to achieve uniform color and appearance.
 - a. Where patching occurs in a smooth painted surface, extend final paint coat over entire surface containing the patch after the area has received primer and second coat.
 4. Patch, repair, or rehang ceilings as necessary to provide an even-plane surface of uniform appearance.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar items. Clean piping, conduit, and similar features before applying paint or finishing materials. Restore damaged pipe covering to its original condition.

END OF SECTION 010450

SECTION 012000 - PROJECT MEETINGS

1.1 GENERAL

- A. This Section specifies administrative and procedural requirements for project meetings, including, but not limited to, the following:
 - 1. Preconstruction conferences.
 - 2. Preinstallation conferences.
 - 3. Progress meetings.
- B. Preconstruction Conference: Schedule a preconstruction conference before starting construction. Review responsibilities and personnel assignments.
- C. Attendees: Authorized representatives of the Owner, Architect, and their consultants; the Contractor and its superintendent; major subcontractors; and other concerned parties shall attend.
 - 1. Participants shall be familiar with the Project and authorized to conclude matters relating to the Work.
- D. Agenda: Discuss items that could affect progress, including the following:
 - 1. Tentative construction schedule.
 - 2. Critical work sequencing.
 - 3. Submittal of Shop Drawings, Product Data, and Samples.
 - 4. Use of the premises.
- E. Preinstallation Conferences: Conduct a conference before each activity that requires coordination with other operations.
- F. Attendees: The Installer and representatives of manufacturers and fabricators involved in or affected by the installation shall attend. Advise the Architect of scheduled meeting dates.
 - 1. Review the progress of other operations and preparations for the activity under consideration at each preinstallation conference, including requirements for the following:
 - a. Compatibility problems and acceptability of substrates.
 - b. Time schedules and deliveries.
 - c. Manufacturer's recommendations.
 - d. Warranty requirements.
 - e. Inspecting and testing requirements.
 - 2. Record significant discussions and agreements and disagreements, and the approved schedule. Promptly distribute the record of the meeting to everyone concerned, including the Owner and the Architect.
 - 3. Do not proceed with the installation if the conference cannot be successfully concluded. Initiate actions necessary to resolve problems and reconvene the conference.
- G. Progress Meetings: Conduct progress meetings at the Project Site at regular intervals. Notify the Owner and the Architect of scheduled dates. Coordinate meeting dates with preparation of the payment request.

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- H. Attendees: The Owner, Architect, and other entities concerned with current progress or involved in planning, coordination, or future activities shall be represented. Participants shall be authorized to conclude matters relating to the Work.
- I. Agenda: Review and correct or approve minutes of the previous meeting. Review items of significance that could affect progress. Include topics for discussion appropriate to Project status.
 - 1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule. Determine how to expedite construction behind schedule; secure commitments from parties involved to do so. Discuss revisions required to insure subsequent activities will be completed within the Contract Time.
 - 2. Review the present and future needs of each entity present, including the following:
 - a. Time.
 - b. Sequences.
 - c. Status of submittals.
 - d. Deliveries and off-site fabrication problems.
 - e. Temporary facilities and services.
 - f. Quality and work standards.
 - g. Change Orders.
 - 3. Reporting: Distribute meeting minutes to each party present and to parties who should have been present. Include a summary of progress since the previous meeting and report.
 - 4. Schedule Updating: Revise the Contractor's Construction Schedule after each meeting where revisions have been made. Issue the revised schedule concurrently with the report of each meeting.

1.2 PRODUCTS (Not Applicable)

1.3 EXECUTION (Not Applicable)

END OF SECTION 012000

SECTION 013000 - SUBMITTALS

1.1 GENERAL

- A. Submittal Procedures: Coordinate submittal preparation with construction, fabrication, other submittals, and activities that require sequential operations. Transmit in advance of construction operations to avoid delay.
1. Coordinate submittals for related operations to avoid delay because of the need to review submittals concurrently for coordination. The Architect reserves the right to withhold action on a submittal requiring coordination until related submittals are received.
 2. Processing: Allow 2 weeks for initial review. Allow more time if the Architect must delay processing to permit coordination. Allow 2 weeks for reprocessing.
 - a. No extension of Contract Time will be authorized because of failure to transmit submittals sufficiently in advance of the Work to permit processing.
 3. Submittal Preparation: Place a permanent label on each submittal for identification. Provide a 4- by 5-inch (100- by 125-mm) space on the label or beside title block to record review and approval markings and action taken. Include the following information on the label for processing and recording action taken.
 - a. Project name.
 - b. Date.
 - c. Name and address of the Architect.
 - d. Name and address of the Contractor.
 - e. Name and address of the subcontractor.
 - f. Name and address of the supplier.
 - g. Name of the manufacturer.
 - h. Number and title of appropriate Specification Section.
 - i. Drawing number and detail references, as appropriate.
 4. Submittal Transmittal: Package each submittal appropriately. Transmit with a transmittal form. The Architect will not accept submittals from sources other than the Contractor.
 5. Transmittal Form: Use AIA Document G810. On the form, record requests for data and deviations from requirements. Include Contractor's certification that information complies with requirements.
- B. Contractor's Construction Schedule: Prepare a horizontal bar-chart-type, contractor's construction schedule. Provide a separate time bar for each activity and a vertical line to identify the first working day of each week. Use the same breakdown of Work indicated in the "Schedule of Values." Indicate estimated completion in 10 percent increments. As Work progresses, mark each bar to indicate actual completion.
1. Submit within 30 days of the date established for "Commencement of the Work."
 2. Prepare the schedule on stable transparency, or other reproducible media, of width to show data for the entire construction period.
 3. Secure performance commitments from parties involved. Coordinate each element with other activities; include minor elements involved in the Work. Show each activity in proper sequence. Indicate sequences necessary for completion of related Work.
 4. Coordinate with the Schedule of Values, list of subcontracts, Submittal Schedule, payment requests, and other schedules.

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5. Indicate completion in advance of Substantial Completion. Indicate Substantial Completion to allow time for the Architect's procedures necessary for certification of Substantial Completion.
 6. Phasing: Show how phased completion affects the Work.
 7. Work Stages: Indicate important stages for each portion of the Work.
 8. Area Separations: Provide a separate time bar to identify each construction area for each portion of the Work. Indicate where each element must be sequenced with other activities.
- C. Submittal Schedule: After developing the Contractor's Construction Schedule, prepare a schedule of submittals. Submit within 10 days of submittal of the Construction Schedule.
1. Coordinate with list of subcontracts, Schedule of Values, list of products, and the Contractor's Construction Schedule.
 2. Prepare the schedule in chronological order. Provide the following information:
 - a. Date for first submittal.
 - b. Related Section number.
 - c. Submittal category (Shop Drawings, Product Data, or Samples).
 - d. Name of the subcontractor.
 - e. Description of the Work covered.
 - f. Date for the Architect's final approval.
 3. Schedule Distribution: Distribute copies of the Contractor's Construction Schedule and the Submittal Schedule to the Architect, Owner, subcontractors, and parties required to comply with submittal dates. Post copies in the field office.
 - a. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their Work and are no longer involved in construction activities.
 - b. Updating: Revise the schedule after each meeting or activity where revisions have been made. Issue the updated schedule concurrently with the report of each meeting.
- D. Daily Construction Reports: Prepare a daily report recording events at the site. Submit duplicate copies to the Architect at weekly intervals. Include the following information:
1. List of subcontractors at the site.
 2. High and low temperatures, general weather conditions.
 3. Accidents and unusual events.
 4. Stoppages, delays, shortages, and losses.
 5. Meter readings and similar recordings.
 6. Emergency procedures.
 7. Orders and requests of governing authorities.
 8. Services connected, disconnected.
 9. Equipment or system tests and startups.
 10. Substantial Completions authorized.
- E. Shop Drawings: Submit newly prepared information drawn to scale. Indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information. Include the following information:
1. Dimensions.
 2. Identification of products and materials included by sheet and detail number.
 3. Compliance with standards.

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4. Notation of coordination requirements.
 5. Notation of dimensions established by field measurement.
 6. Sheet Size: Except for templates and full-size Drawings, submit one correctable, reproducible print and one blue- or black-line print on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 36 by 48 inches (890 by 1220 mm). The Architect will return the reproducible print.
 - a. Do not use Shop Drawings without an appropriate final stamp indicating action taken.
- F. Product Data: Collect Product Data into a single submittal for each element of construction. Mark each copy to show applicable choices and options. Where Product Data includes information on several products, mark copies to indicate applicable information.
1. Include the following information:
 - a. Manufacturer's printed recommendations.
 - b. Compliance with trade association standards.
 - c. Compliance with recognized testing agency standards.
 - d. Application of testing agency labels and seals.
 - e. Notation of dimensions verified by field measurement.
 - f. Notation of coordination requirements.
 2. Preliminary Submittal: Submit a preliminary single copy of Product Data where selection of options is required.
 3. Submittals: Submit 5 copies; submit 6 copies where required for maintenance manuals. The Architect will retain one and return the other marked with action taken.
 - a. Unless noncompliance with Contract Documents is observed, the submittal serves as the final submittal.
 4. Distribution: Furnish copies to installers, subcontractors, suppliers, and others required for performance of construction activities. Show distribution on transmittal forms. Do not proceed with installation until a copy of Product Data is in the Installer's possession.
 - a. Do not use unmarked Product Data for construction.
- G. Samples: Submit full-size Samples cured and finished as specified and identical with the material proposed. Mount Samples to facilitate review of qualities.
1. Include the following:
 - a. Specification Section number and reference.
 - b. Generic description of the Sample.
 - c. Sample source.
 - d. Product name or name of the manufacturer.
 - e. Compliance with recognized standards.
 - f. Availability and delivery time.
 2. Submit Samples for review of size, kind, color, pattern, and texture, for a check of these characteristics, and for a comparison of these characteristics between the final submittal and the actual component as delivered and installed. Where variations are inherent in the material, submit at least 3 units that show limits of the variations.

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- a. Refer to other Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar characteristics.
 - b. Refer to other Sections for Samples to be incorporated in the Work. Samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of Sample submittals.
 - c. Samples not incorporated into the Work, or designated as the Owner's property, are the Contractor's property and shall be removed from the site.
3. Preliminary Submittals: Submit a full set of choices where Samples are submitted for selection of color, pattern, texture, or similar characteristics from standard choices. The Architect will review and return submittals indicating selection and other action.
 4. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics, submit 3 sets. One set will be returned marked with the action taken. Maintain sets of Samples, at the Project Site, for quality comparison.
 - a. Unless noncompliance with Contract Documents is observed, the submittal may serve as the final submittal.
 - b. Sample sets may be used to obtain final acceptance of the construction associated with each set.
 5. Distribution of Samples: Distribute additional sets to subcontractors, manufacturers, and others as required for performance of the Work. Show distribution on transmittal forms.
- H. Quality Assurance Submittals: Submit quality-control submittals, including design data, certifications, manufacturer's instructions, and manufacturer's field reports required under other Sections of the Specifications.
1. Certifications: Where certification that a product or installation complies with specified requirements is required, submit a notarized certification from the manufacturer certifying compliance.
 - a. Signature: Certification shall be signed by an officer authorized to sign documents on behalf of the company.
- I. Architect's Action: Except for submittals for the record or information, where action and return are required, the Architect will review each submittal, mark to indicate action taken, and return. Compliance with specified characteristics is the Contractor's responsibility.
1. Action Stamp: The Architect will stamp each submittal with an action stamp. The Architect will mark the stamp appropriately to indicate the action taken.
- 1.2 PRODUCTS (Not Applicable)
- 1.3 EXECUTION (Not Applicable)

END OF SECTION 013000

SECTION 014000 - QUALITY CONTROL

1.1 GENERAL

- A. Quality-control services include inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities. They do not include contract enforcement activities performed by the Architect.
- B. Contractor Responsibilities: Unless they are the responsibility of another entity, Contractor shall provide inspections and tests specified elsewhere and required by authorities having jurisdiction. Costs for these services are included in the Contract Sum.
 - 1. Where inspections and tests are the Contractor's responsibility, the Contractor shall employ and pay a qualified independent testing agency to perform these services. Costs for these services are included in the Contract Sum.
 - 2. Where inspections and tests are the Owner's responsibility, the Owner will employ and pay a qualified independent testing agency to perform those services.
 - 3. Where inspections and tests are the Owner's responsibility, the Owner will engage the services of a qualified independent testing agency to perform those services. Payment will be made from the Inspection and Testing Allowance, as authorized by Change Orders.
 - a. Where the Owner engages an agency to test or inspect part of the Work and the Contractor is required to engage an entity to test or inspect the same or related element, the Contractor shall not employ the entity engaged by the Owner, unless the Owner agrees in writing.
- C. Retesting: The Contractor is responsible for retesting where results of inspections and tests prove unsatisfactory and indicate noncompliance with requirements.
 - 1. The cost of retesting is the Contractor's responsibility where tests performed indicated noncompliance with requirements.
- D. Auxiliary Services: Cooperate with agencies performing inspections and tests. Provide auxiliary services as requested. Notify the agency in advance of operations to permit assignment of personnel. Auxiliary services include the following:
 - 1. Providing access to the Work.
 - 2. Furnishing incidental labor and facilities to assist inspections and tests.
 - 3. Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.
 - 4. Providing facilities for storage and curing of test samples.
 - 5. Delivering samples to testing laboratories.
 - 6. Providing preliminary design mix proposed for use for materials mixes that require control by the testing agency.
 - 7. Providing security and protection of samples and test equipment.
- E. Duties of the Testing Agency: The testing agency shall cooperate with the Architect and the Contractor in performing its duties. The agency shall provide qualified personnel to perform inspections and tests.
 - 1. The agency shall notify the Architect and the Contractor of irregularities or deficiencies observed in the Work during performance of its services.

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2. The agency shall not release, revoke, alter, or enlarge requirements or approve or accept any portion of the Work.
 3. The agency shall not perform duties of the Contractor.
- F. Coordination: Coordinate activities to accommodate services with a minimum of delay. Avoid removing and replacing construction to accommodate inspections and tests.
1. The Contractor is responsible for scheduling inspections, tests, taking samples, and similar activities.
- G. Submittals: The testing agency shall submit a certified written report, in duplicate, of each inspection and test to the Architect. If the Contractor is responsible for the service, submit a certified written report, in duplicate, of each inspection or test through the Contractor.
1. Submit additional copies of each report to the governing authority, when the authority so directs.
 2. Report Data: Reports of each inspection, test, or similar service include, but are not limited to, the following:
 - a. Date of issue.
 - b. Project title and number.
 - c. Name, address, and telephone number of testing agency.
 - d. Dates and locations of samples and tests or inspections.
 - e. Names of individuals making the inspection or test.
 - f. Designation of the Work and test method.
 - g. Identification of product and Specification Section.
 - h. Complete inspection or test data.
 - i. Test results and an interpretation of test results.
 - j. Ambient conditions at the time of sample taking and testing.
 - k. Comments or professional opinion on whether inspected or tested Work complies with requirements.
 - l. Name and signature of laboratory inspector.
 - m. Recommendations on retesting.
- H. Qualifications for Service Agencies: Engage inspection and testing service agencies that are prequalified as complying with the American Council of Independent Laboratories' "Recommended Requirements for Independent Laboratory Qualification" and that specialize in the types of inspections and tests to be performed.
1. Each agency shall be authorized by authorities having jurisdiction to operate in the state where the Project is located.
- 1.2 PRODUCTS (Not Applicable)
- 1.3 EXECUTION
- A. Repair and Protection: Upon completion of inspection, testing, and sample taking, repair damaged construction. Restore substrates and finishes. Comply with Division 1 Section "Cutting and Patching."
 - B. Protect construction exposed by or for quality-control service activities, and protect repaired construction.

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- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for inspection and testing.

END OF SECTION 014000

SECTION 014210 - REFERENCE STANDARDS AND DEFINITIONS

1.1 GENERAL

- A. Definitions: Basic contract definitions are included in the Conditions of the Contract.
- B. "Indicated" refers to graphic representations, notes, or schedules on the Drawings; or to other paragraphs or schedules in the Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference. Location is not limited.
- C. "Directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by the Architect, requested by the Architect, and similar phrases.
- D. "Approved," when used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, is limited to the Architect's duties and responsibilities as stated in the Conditions of the Contract.
- E. "Regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish" means to supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install" describes operations at the Project site including the actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide" means to furnish and install, complete and ready for the intended use.
- I. "Owner Provided" means furnished by owner. Installation by owner is not to be assumed unless stated.
- J. "Installer" is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, or similar operations. Installers are required to be experienced in the operations they are engaged to perform.
 - 1. The term "experienced," when used with the term "installer," means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction.
 - 2. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter."
- K. "Project site" is the space available to the Contractor for performing construction activities, either exclusively or in conjunction with others performing other work as part of the Project. The extent of the Project site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.

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- L. "Testing Agencies": A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.
 - M. Specification Format: These Specifications are organized into Divisions and Sections based on the 16-division format and CSI/CSC's "MasterFormat" numbering system.
 - N. Specification Content: These Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be interpolated as the sense requires. Singular words shall be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.
 - 2. Streamlined language is generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Section Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor or by others when so noted.
 - a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - O. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
 - P. Publication Dates: Comply with standards in effect as of the date of the Contract Documents.
 - Q. Copies of Standards: Copies of applicable standards are not bound with the Contract Documents. Where copies of standards are needed to perform a required construction activity, the Contractor shall obtain copies directly from the publication source and make them available on request.
 - R. Abbreviations and Names: Where abbreviations and acronyms are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards-producing organization, authorities having jurisdiction, or other entity applicable to the context of the text provision. Refer to Gale Research's "Encyclopedia of Associations" or Columbia Books' "National Trade & Professional Associations of the U.S.," which are available in most libraries.
 - S. Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.
- 1.2 PRODUCTS (Not Applicable)
- 1.3 EXECUTION (Not Applicable)

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END OF SECTION 014210

SECTION 015000 - CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

1.1 GENERAL

- A. Summary: This Section specifies construction facilities and temporary controls including temporary utilities, support facilities, and security and protection facilities.
- B. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:
 - 1. Building code requirements.
 - 2. Health and safety regulations.
 - 3. Utility company regulations.
 - 4. Police, fire department, and rescue squad rules.
 - 5. Environmental protection regulations.
- C. Standards: Comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations," ANSI A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities."
 - 1. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 "National Electric Code."
- D. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.
- E. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. Submit reports of tests, inspections, meter readings, and procedures performed on temporary utilities. At the earliest time, change over from use of temporary service to use of permanent service.

1.2 PRODUCTS

- A. Materials: Provide new materials. If acceptable to the Architect, the Contractor may use undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended.
 - 1. Lumber and Plywood: Comply with Division 6 Section "Rough Carpentry." Provide UL-labeled, fire-treated lumber and plywood for temporary offices and sheds. Provide exterior, Grade B-B high-density concrete form overlay plywood for signs. Provide 5/8-inch- (16-mm-) thick exterior plywood for other uses.
 - 2. Roofing Materials: UL Class A standard-weight asphalt shingles or UL Class C mineral-surfaced roll roofing on roofs of temporary offices, shops, and sheds.
 - 3. Paint: Comply with Division 9 Section "Painting."
 - a. For exposed lumber and plywood, provide exterior-grade acrylic-latex emulsion over exterior primer.
 - b. For sign panels and applying graphics, provide exterior-grade alkyd gloss enamel over exterior primer.
 - c. For interior walls of temporary offices, provide 2 coats interior latex-flat wall paint.

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4. Tarpaulins: Waterproof, fire-resistant, UL-labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures, provide translucent, nylon-reinforced, laminated polyethylene or polyvinyl chloride, fire-retardant tarpaulins.
 5. Water: Potable water approved by local health authorities.
 6. Open-Mesh Fencing: 0.120-inch- (3-mm-) thick, galvanized 2-inch (50-mm) chainlink fabric fencing 6 feet (2 m) high with galvanized barbed-wire top strand and galvanized steel pipe posts, 1-1/2 inches (38 mm) I.D. for line posts and 2-1/2 inches (64 mm) I.D. for corner posts.
- B. Equipment: Provide new equipment. If acceptable to the Architect, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.
1. Water Hoses: 3/4-inch (19-mm), heavy-duty, abrasion-resistant, flexible rubber hoses 100 feet (30 m) long. Provide adjustable shutoff nozzles at hose discharge.
 2. Electrical Outlets: Properly configured, NEMA-polarized outlets. Provide outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.
 3. Electrical Power Cords: Grounded extension cords. Use hard-service cords where exposed to abrasion and traffic.
 4. Lamps and Light Fixtures: General service incandescent lamps. Provide guard cages or tempered-glass enclosures where exposed to breakage. Provide exterior fixtures where exposed to moisture.
 5. Heating Units: Temporary heating units that have been tested and labeled by UL, FM, or another recognized trade association related to the type of fuel being consumed.
 6. Fire Extinguishers: Hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for the exposures.
 - a. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

1.3 EXECUTION

- A. Installation, General: Use qualified personnel to install temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.
1. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.
 2. Conditions of Use: Keep temporary facilities clean and neat in appearance. Operate safely and efficiently. Relocate as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.
- B. Temporary Utility Installation: Engage the local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.

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1. Arrange with company and existing users for a time when service can be interrupted to make connections for temporary services.
2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
3. Obtain easements to bring temporary utilities to the site where the Owner's easements cannot be used for that purpose.
4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Architect. Neither the Owner nor Architect will accept cost or use charges as a basis of claims for Change Orders.
5. Temporary Water Service: Install temporary water service and distribution piping of sizes and pressures adequate for construction. Maintain service until permanent water service is in use. Sterilize piping prior to use.
6. Temporary Electric Power: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics. Include meters, transformers, overload-protected disconnects, automatic ground-fault interrupters, and main distribution switch gear. Install service underground.
 - a. Power Distribution: Install wiring overhead and rise vertically where least exposed to damage.
 - b. Temporary Lighting: Provide temporary lighting with local switching to fulfill security requirements and illumination for construction operations and traffic conditions.
7. Temporary Heat: Provide temporary heat for curing or drying of completed installations or for protection of installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations. Coordinate ventilation requirements to produce ambient condition required and minimize consumption of energy.
 - a. Heating Facilities: Except where the Owner authorizes use of the permanent system, provide vented, self-contained, LP-gas or fuel-oil heaters with individual space thermostatic control. Use of gasoline-burning space heaters, open flame, or salamander heating units is prohibited.
8. Temporary Telephones: Provide temporary telephone service for personnel engaged in construction. Install a separate line for each temporary office and first-aid station. Provide a dedicated telephone line for a fax machine in the field office. At each telephone, post a list of important telephone numbers.
9. Sanitary Facilities: Comply with regulations and health codes for the type, number, location, operation, and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs. Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Provide covered waste containers.
 - a. Toilets: Install self-contained, single-occupant toilet units of the chemical, aerated recirculation, or combustion type. Provide units properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material. Shield toilets to ensure privacy. Use of pit-type privies will not be permitted.
 - b. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up. Dispose of drainage properly. Supply cleaning compounds.
 - 1) Provide safety showers, eyewash fountains, and similar facilities for safety, and sanitation of personnel.
 - c. Drinking-Water Facilities: Provide containerized, tap-dispenser, bottled drinking-water units.

10. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.
 - a. Filter out soil, construction debris, chemicals, and similar contaminants that might clog sewers or pollute waterways.
 - b. Connect temporary sewers to the municipal system, as directed by sewer department officials. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. Following heavy use, restore normal conditions promptly.
 - c. Provide earthen embankments and similar barriers in and around excavations and subgrade construction to prevent flooding by runoff of storm water from heavy rains.

- C. Support Facilities Installation: Locate field offices, storage sheds, and other construction and support facilities for easy access. Maintain facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
 1. Provide incombustible construction for offices, shops, and sheds located within the construction area or within 30 feet (9 m) of building lines. Comply with requirements of NFPA 241.
 2. Field Offices: Provide heated and air-conditioned, insulated, weathertight temporary offices of size to accommodate personnel at the Project Site. Provide offices on foundations adequate for normal loading. Provide units with lockable entrances, operable windows, and serviceable finishes. Keep the office clean and orderly for use for small progress meetings. Furnish and equip offices as follows:
 - a. Furnish field offices with a desk and chairs, a 4-drawer file cabinet, plan table, plan rack, and a 6-shelf bookcase. Equip with a water cooler and toilet complete with water closet, lavatory, and medicine cabinet unit with a mirror.
 3. Storage and Fabrication Sheds: Install sheds equipped to accommodate materials and equipment involved. Sheds may be open shelters or fully enclosed spaces within the building.
 4. Temporary Paving: Construct temporary paving for roads, storage areas, and parking where the same permanent facilities will be located. Comply with Division 2 Section "Hot-Mixed Asphalt Paving."
 - a. Coordinate temporary paving development with subgrade grading, compaction, installation and stabilization of subbase, and installation of base and finish courses of permanent paving.
 - 1) Install temporary paving to minimize the need to rework the installations and to result in permanent roads and paved areas without damage or deterioration when occupied by the Owner.
 - b. Delay installation of the final course of permanent paving until immediately before Substantial Completion. Coordinate with weather conditions to avoid unsatisfactory results.
 - c. Extend temporary paving in and around the construction area as necessary to accommodate delivery and storage of materials, equipment usage, administration, and supervision.

5. Dewatering Facilities and Drains: For temporary drainage and dewatering operations not directly associated with construction, comply with dewatering requirements of applicable Division 2 Sections. Where feasible, utilize the same facilities. Maintain excavations and construction free of water.
 6. Temporary Enclosures: Provide temporary enclosures for protection of construction from exposure, foul weather, other construction operations, and similar activities. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions.
 - a. Install tarpaulins securely, with incombustible wood framing and other materials. Close openings of 25 sq. ft. (2.3 sq. m) or less with plywood or similar materials.
 - b. Close openings through floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
 7. Temporary Lifts and Hoists: Provide facilities for hoisting materials and employees.
 8. Temporary Elevator Use: Refer to Division 14 Sections for elevators.
 9. Project Signs: Install project identification and other signs where indicated to inform the public and persons seeking entrance to the Project. Support on framing of preservative-treated wood or steel. Do not permit installation of unauthorized signs. Engage an experienced sign painter to apply graphics. Comply with details indicated.
 10. Temporary Exterior Lighting: Install exterior yard and sign lights so signs are visible when Work is being performed.
 11. Waste Collection and Disposal: Collect waste daily. Comply with requirements of NFPA 241. Enforce requirements strictly. Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material lawfully.
 - a. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg F (27 deg C).
 12. Pest Control: Retain an exterminator or pest control company to perform extermination and control procedures at regular intervals so the Project will be free of pests at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
 13. Stairs: Provide temporary stairs where ladders are not adequate. Cover finished, permanent stairs with a protective covering of plywood or similar material so finishes will be undamaged at the time of acceptance.
- D. Security and Protection Facilities Installation: Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion.
1. Temporary Fire Protection: Until permanent facilities supply fire-protection needs, install and maintain temporary fire-protection facilities of types needed to protect against controllable fire losses. Comply with NFPA 10 and NFPA 241.
 - a. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell. Maintain unobstructed access to fire extinguishers.
 - b. Store combustible materials in containers in fire-safe locations.
 - c. Prohibit smoking in hazardous fire-exposure areas.
 - d. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.

2. Permanent Fire Protection: At the earliest date, complete installation of the permanent fire-protection facility and place into operation and use. Instruct key personnel on use of facilities.
 3. Barricades, Warning Signs, and Lights: Comply with code requirements for erection of barricades. Paint with appropriate colors, graphics, and warning signs. Where appropriate and needed, provide lighting, including flashing red or amber lights.
 4. Enclosure Fence: Before excavation begins, install an enclosure fence with lockable entrance gates to enclose the entire site or the portion sufficient to accommodate construction.
 - a. Provide open-mesh, chainlink fencing with posts set in a compacted mixture of gravel and earth or portable chain link fencing.
 - b. Provide plywood fence, 8 feet (2.5 m) high, framed with four 2-by-4-inch (50-by-100-mm) rails, and preservative-treated wood posts spaced not more than 8 feet (2.5 m) apart.
 5. Covered Walkway: Erect a protective covered walkway along the adjacent public street. Coordinate with entrance gates. Comply with regulations of authorities having jurisdiction.
 - a. Construct walkways using wood plank overhead decking, protective plywood enclosure walls, handrails, barricades, warning signs, lights, safe and well-drained walkways, and similar provisions for protection. Extend back wall beyond the structure to complete the enclosure fence. Paint and maintain in a manner acceptable to the Owner.
 6. Security Enclosure and Lockup: Install temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, and theft. Provide a secure lockup where materials and equipment are of value and must be stored.
 7. Environmental Protection: Operate temporary facilities and conduct construction in ways that comply with environmental regulations and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted. Avoid use of tools and equipment that produce harmful noise. Restrict use of noise-making equipment to hours that will minimize complaints.
- E. Operation: Enforce discipline in use of temporary facilities. Limit availability to intended uses to minimize waste and abuse.
- F. Maintenance: Maintain facilities in operating condition until removal. Protect from damage by freezing temperatures and similar elements. Maintain temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid damage.
- G. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect during excavation.
- H. Termination and Removal: Remove each temporary facility when the need has ended, when replaced by a permanent facility, or no later than Substantial Completion. Complete or restore permanent construction delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and temporary facilities are the Contractor's property. The Owner reserves the right to take possession of project identification signs.

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2. Remove temporary paving. Where the area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil in the area. Remove materials contaminated with oil, asphalt and other petrochemical compounds, and substances that might impair growth of plant materials or lawns. Repair or replace paving, curbs, and sidewalks at the temporary entrances, as required by the governing authority.
3. At Substantial Completion, clean and renovate permanent facilities used during the construction period.
 - a. Replace air filters and clean inside of ductwork and housings.
 - b. Replace worn parts and parts subject to unusual operating conditions.
 - c. Replace burned out lamps.

END OF SECTION 015000

SECTION 016000 - MATERIALS AND EQUIPMENT

1.1 GENERAL

- A. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock.
 - 1. "Named Products" are items identified by the manufacturer's product name, including make or model number or designation, shown or listed in the manufacturer's published product literature.
- B. "Materials" are products substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.
- C. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.
- D. Product List: A list of products required is included at the end of this Section. Prepare a schedule in tabular form showing each product listed. Include the manufacturer's name and proprietary product names for each item listed. Coordinate product list with the Contractor's Construction Schedule and Submittal Schedule.
 - 1. Form: Prepare product list with information on each item tabulated under the following column headings:
 - a. Related Specification Section number.
 - b. Generic name used in Contract Documents.
 - c. Proprietary name, model number, and similar designations.
 - d. Manufacturer's name and address.
 - e. Supplier's name and address.
 - f. Installer's name and address.
 - g. Projected delivery date or time span of delivery period.
 - 2. Within 60 days after date of commencement of the Work, submit 3 copies of the product list. Provide a written explanation for omissions of data and variations from Contract requirements.
 - 3. The Architect will respond within 2 weeks of receipt of the list. No response within this period constitutes no objection to listed manufacturers or products but does not waive the requirement that products comply with Contract Documents. The Architect's response will include a list of unacceptable products.
- E. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.
 - 1. When the Contractor is given the option of selecting between 2 or more products for use on the Project, the product selected shall be compatible with products previously selected.
- F. Nameplates: Except for required labels and operating data, do not attach manufacturer's nameplates or trademarks on surfaces exposed to view in occupied spaces or on the exterior.

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1. Labels: Locate required product labels and stamps on concealed surfaces or, where required for observation after installation, on accessible surfaces that are not conspicuous.
 2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface that is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:
 - a. Name of product and manufacturer.
 - b. Model and serial number.
 - c. Capacity.
 - d. Speed.
 - e. Ratings.
- G. Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.
1. Schedule delivery to minimize long-term storage and to prevent overcrowding construction spaces. Coordinate with installation to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 2. Deliver products in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 3. Inspect products upon delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
 4. Store products to facilitate inspection and measurement of quantity or counting of units. Store heavy materials away from the structure in a manner that will not endanger the supporting construction.
 5. Store products subject to damage by the elements aboveground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

1.2 PRODUCTS

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, new at the time of installation.
1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and the intended use and effect.
 2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
- B. Product Selection Procedures: Procedures governing product selection include the following:
1. Proprietary Specification Requirements: Where Specifications name only a single product or manufacturer, provide the product indicated. No substitutions will be permitted.
 2. Semiproprietary Specification Requirements: Where Specifications name 2 or more products or manufacturers, provide 1 of the products indicated. No substitutions will be permitted.

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- a. Where products are specified by name, accompanied by the term "or equal," comply with provisions concerning "substitutions" to obtain approval for use of an unnamed product.
3. Nonproprietary Specifications: When Specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with Contract requirements. Comply with Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
4. Descriptive Specification Requirements: Where Specifications describe a product, listing characteristics required, with or without use of a brand name, provide a product that provides the characteristics and otherwise complies with requirements.
5. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply and are recommended for the application. Manufacturer's recommendations may be contained in product literature or by the manufacturer's certification of performance.
6. Compliance with Standards, Codes, and Regulations: Where Specifications only require compliance with an imposed code, standard, or regulation, select a product that complies with the standards, codes, or regulations specified.
7. Visual Matching: Where Specifications require matching a Sample, the Architect's decision on whether a product matches will be final. Where no product in the specified category matches and complies with other requirements, comply with provisions concerning "substitutions" for selection of a matching product in another category.
8. Visual Selection: Where requirements include the phrase "... as selected from manufacturer's standard colors, patterns, textures ..." or a similar phrase, select a product that complies with other requirements. The Architect will select the color, pattern, and texture from the product line selected.

1.3 EXECUTION

- A. Comply with manufacturer's instructions for installation of products. Anchor each product securely in place, accurately located and aligned with other Work. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION 016000

SECTION 016310 - SUBSTITUTIONS

1.1 GENERAL

- A. Substitutions: Changes in products, materials, equipment, and methods of construction required by the Contract Documents proposed after award of the Contract are considered requests for substitutions. The following are not requests for substitutions:
1. Substitutions requested during the bidding period and accepted by Addendum prior to award of the Contract.
 2. Revisions to the Contract Documents requested by the Owner.
 3. Specified options included in the Contract Documents.
 4. Contractor's compliance with regulations issued by governing authorities.
- B. Substitution Request Submittal: The Architect will consider requests for substitution received within 60 days after commencement of the Work.
1. Submit 3 copies of each request for substitution. Submit requests according to procedures required for change-order proposals.
 2. Identify the product or method to be replaced in each request. Include related Specification Section and Drawing numbers.
 3. Provide documentation showing compliance with the requirements for substitutions and the following information:
 - a. Coordination information, including a list of changes needed to other Work that will be necessary to accommodate the substitution.
 - b. A comparison of the substitution with the Work specified, including performance, weight, size, durability, and visual effect.
 - c. Product Data, including Drawings and descriptions of products and installation procedures.
 - d. Samples, where applicable or requested.
 - e. A statement indicating the effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the substitution on Contract Time.
 - f. Cost information, including a proposal of the net change, if any in the Contract Sum.
 - g. Certification that the substitution conforms to the Contract Documents and is appropriate for the applications indicated.
 - h. The Contractor's waiver of rights to additional payment or time that may become necessary because of the failure of the substitution to perform adequately.
 4. Architect's Action: If necessary, the Architect will request additional information within one week of receipt of a request for substitution. The Architect will notify the Contractor of acceptance or rejection within 2 weeks of receipt of the request. Acceptance will be in the form of a change order.
 - a. Use the product specified if the Architect cannot make a decision within the time allocated.

1.2 PRODUCTS

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- A. Conditions: The Architect will receive and consider a request for substitution when one or more of the following conditions are satisfied. Otherwise, the Architect will return the requests without action except to record noncompliance with these requirements.
1. Extensive revisions to the Contract Documents are not required.
 2. Changes are in keeping with the intent of the Contract Documents.
 3. The specified product cannot be provided within the Contract Time. The Architect will not consider the request if the specified product cannot be provided as a result of failure to pursue the Work promptly.
 4. The request is related to an "or-equal" clause.
 5. The substitution offers the Owner a substantial advantage, in cost, time, or other considerations, after deducting compensation to the Architect for redesign and increased cost of other construction.
 6. The specified product cannot receive approval by a governing authority, and the substitution can be approved.
- B. The Contractor's submittal and the Architect's acceptance of Shop Drawings, Product Data, or Samples for construction not complying with the Contract Documents do not constitute an acceptable request for substitution, nor do they constitute approval.

1.3 EXECUTION (Not Applicable)

END OF SECTION 016310

SECTION 017000 - CONTRACT CLOSEOUT

1.1 GENERAL

- A. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions 2 through 16.
- B. Substantial Completion: Before requesting inspection for certification of Substantial Completion, complete the following:
 - 1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the Work claimed as substantially complete.
 - a. Include supporting documentation for completion and an accounting of changes to the Contract Sum.
 - 2. Advise the Owner of pending insurance changeover requirements.
 - 3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.
 - 4. Submit record drawings, maintenance manuals, final project photographs, damage or settlement surveys, property surveys, and similar final record information.
 - 5. Deliver tools, spare parts, extra stock, and similar items.
 - 6. Changeover locks and transmit keys to the Owner.
 - 7. Complete startup testing of systems and instruction of operation and maintenance personnel. Remove temporary facilities, mockups, construction tools, and similar elements.
 - 8. Complete final cleanup requirements, including touchup painting.
 - 9. Touch up and repair and restore marred, exposed finishes.
- C. Inspection Procedures: On receipt of a request for inspection, the Architect will proceed or advise the Contractor of unfilled requirements. The Architect will prepare the Certificate of Substantial Completion following inspection or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.
 - 1. The Architect will repeat inspection when requested and assured that the Work is substantially complete.
 - 2. Results of the completed inspection will form the basis of requirements for final acceptance.
- D. Final Acceptance: Before requesting inspection for certification of final acceptance and final payment, complete the following:
 - 1. Final payment request with releases and supporting documentation. Include insurance certificates where required.
 - 2. Submit a statement, accounting for changes to the Contract Sum.
 - 3. Submit a copy of the final inspection list stating that each item has been completed or otherwise resolved for acceptance.
 - 4. Submit final meter readings for utilities, a record of stored fuel, and similar data as of the date of Substantial Completion.
 - 5. Submit consent of surety to final payment.
 - 6. Submit a final settlement statement.

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7. Submit evidence of continuing insurance coverage complying with insurance requirements.
- E. Reinspection Procedure: The Architect will reinspect the Work upon receipt of notice that the Work has been completed, except for items whose completion is delayed under circumstances acceptable to the Architect.
 1. Upon completion of reinspection, the Architect will prepare a certificate of final acceptance. If the Work is incomplete, the Architect will advise the Contractor of Work that is incomplete or obligations that have not been fulfilled but are required.
 2. If necessary, reinspection will be repeated.
- F. Record Document Submittals: Do not use record documents for construction. Protect from loss in a secure location. Provide access to record documents for the Architect's reference.
- G. Record Drawings: Maintain a set of prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark the drawing most capable of showing conditions fully and accurately. Give attention to concealed elements.
 1. Mark sets with red pencil. Use other colors to distinguish between variations in separate categories of the Work.
 2. Organize record drawing sheets into manageable sets. Bind with durable-paper cover sheets; print titles, dates, and other identification on the cover of each set.
- H. Record Specifications: Maintain one copy of the Project Manual, including addenda. Mark to show variations in Work performed in comparison with the text of the Specifications and modifications. Give attention to substitutions and selection of options and information on concealed construction. Note related record drawing information and Product Data.
 1. Upon completion of the Work, submit record Specifications to the Architect for the Owner's records.
- I. Maintenance Manuals: Organize operation and maintenance data into sets of manageable size. Bind in individual, heavy-duty, 3-inch (51-mm), 3-ring, binders, with pocket folders for folded sheet information. Mark identification on front and spine of each binder. Include the following information:
 1. Emergency instructions.
 2. Spare parts list.
 3. Copies of warranties.
 4. Wiring diagrams.
 5. Shop Drawings and Product Data.

1.2 PRODUCTS (Not Applicable)

1.3 EXECUTION

- A. Operation and Maintenance Instructions: Arrange for each Installer of equipment that requires maintenance to provide instruction in proper operation and maintenance. Include a detailed review of the following items:
 1. Maintenance manuals.

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2. Spare parts, tools, and materials.
 3. Lubricants and fuels.
 4. Identification systems.
 5. Control sequences.
 6. Hazards.
 7. Warranties and bonds.
 8. Maintenance agreements and similar continuing commitments.
- B. As part of instruction for operating equipment, demonstrate the following:
1. Startup and shutdown.
 2. Emergency operations and safety procedures.
 3. Noise and vibration adjustments.
- C. Final Cleaning: Employ experienced cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Complete the following operations before requesting inspection for certification of Substantial Completion.
1. Remove labels that are not permanent labels.
 2. Clean transparent materials, including mirrors and glass. Remove glazing compounds. Replace chipped or broken glass.
 3. Clean exposed finishes to a dust-free condition, free of stains, films, and foreign substances. Leave concrete floors broom clean. Vacuum carpeted surfaces.
 4. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication. Clean plumbing fixtures. Clean light fixtures and lamps.
 5. Clean the site of rubbish, litter, and foreign substances. Sweep paved areas; remove stains, spills, and foreign deposits. Rake grounds to a smooth, even-textured surface.
- D. Pest Control: Engage a licensed exterminator to make a final inspection and rid the Project of rodents, insects, and other pests.
- E. Removal of Protection: Remove temporary protection and facilities.
- F. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Remove waste materials and dispose of lawfully.

END OF SECTION 017000

SECTION 017400 - WARRANTIES

1.1 GENERAL

- A. Standard product warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
- B. Special warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.
 - 1. Refer to the General Conditions for terms of the Contractor's period for correction of the Work.
- C. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.
- D. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.
- E. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- F. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.
- G. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.
 - 1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 - 2. Where the Contract Documents require a special warranty, or similar commitment, the Owner reserves the right to refuse to accept the Work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.
- H. Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion, submit written warranties upon request of the Architect.

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1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect within 15 days of completion of that designated portion of the Work.
 - I. When the Contract Documents require the Contractor, or the Contractor and a subcontractor, supplier or manufacturer to execute a special warranty, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner, through the Architect, for approval prior to final execution.
 1. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.
 - J. Bind warranties and bonds in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (115-by-280-mm) paper.
 1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the Installer.
 2. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project title or name, and name of the Contractor.
 3. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.
- 1.2 PRODUCTS (Not Applicable)
- 1.3 EXECUTION
- A. Schedule: Provide warranties on products and installations as specified in the following Sections:

END OF SECTION 017400

SECTION 025110 - HOT-MIX ASPHALT PAVING

1.1 GENERAL

- A. Submittals: Product Data, material certificates, and the following:
 - 1. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
 - 2. Job-Mix Designs: For each job mix proposed for the Work.
- B. Installer Qualifications: Engage an experienced installer who has completed hot-mix asphalt paving similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- C. Manufacturer Qualifications: Manufacturer of hot-mix asphalt shall be a registered and approved paving mix manufacturer with authorities having jurisdiction or with the DOT of the state in which Project is located.
- D. Regulatory Requirements: Conform to applicable standards of authorities having jurisdiction for asphalt paving work on public property.
- E. Asphalt-Paving Publication: Comply with AI's "The Asphalt Handbook," except where more stringent requirements are indicated.
- F. Environmental Limitations: Do not apply asphalt materials if substrate is wet or excessively damp or if the following conditions are not met:
 - 1. Prime and Tack Coats: Minimum surface temperature of 60 deg F (15.5 deg C).
 - 2. Asphalt Base Course: Minimum surface temperature of 40 deg F (4 deg C) and rising at time of placement.
 - 3. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.5 deg C) at time of placement.
- G. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F (4 deg C) for oil-based materials, 50 deg F (10 deg C) for water-based materials, and not exceeding 95 deg F (35 deg C).

1.2 PRODUCTS

- A. Coarse Aggregate: Sound; angular crushed stone; crushed gravel; or properly cured, crushed blast-furnace slag; complying with ASTM D 692.
- B. Fine Aggregate: Sharp-edged natural sand or sand prepared from stone; gravel, properly cured blast-furnace slag, or combinations thereof; complying with ASTM D 1073.
- C. Mineral Filler: Rock or slag dust, hydraulic cement, or other inert material complying with ASTM D 242.
- D. Asphalt Cement: ASTM D 3381 for viscosity-graded material; ASTM D 946 for penetration-graded material.
- E. Prime Coat: ASTM D 2027; medium-curing cutback asphalt; MC-30, MC-70, or MC-250.

- F. Prime Coat: Asphalt emulsion prime conforming to state DOT requirements.
- G. Tack Coat: ASTM D 977, emulsified asphalt or ASTM D 2397, cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.
- H. Herbicide: Commercial chemical for weed control, registered by Environmental Protection Agency (EPA). Provide granular, liquid, or wettable powder form.
- I. Pavement-Marking Paint: Alkyd-resin type, ready-mixed, complying with FS TT-P-115, Type I, or AASHTO M-248, Type N.
- J. Pavement-Marking Paint: Latex, water-base emulsion, ready-mixed, complying with FS TT-P-1952.
- K. Wheel Stops: Precast, air-entrained concrete, 2500-psi (17.2-MPa) minimum compressive strength, approximately 6 inches (150 mm) high, 9 inches (225 mm) wide, and 84 inches (2130 mm) long. Provide chamfered corners and drainage slots on underside, and provide holes and galvanized steel dowels for anchoring to substrate.
- L. Hot-Mix Asphalt: Provide dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction; designed according to procedures in AI's "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types"; and complying with the following requirements:
 - 1. Base Course: As indicated.
 - 2. Surface Course: As indicated.

1.3 EXECUTION

- A. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.
 - 1. Before placing asphalt materials, remove loose and deleterious material from substrate surfaces.
- B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions.
- C. Prime Coat: Apply uniformly over surface of compacted-aggregate base at a rate of 0.15 to 0.50 gal./sq. yd. (0.7 to 2.3 L/sq. m). Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure for 72 hours minimum.
- D. Tack Coat: Apply uniformly to existing surfaces of previously constructed asphalt or portland cement concrete paving and to surfaces abutting or projecting into new, hot-mix asphalt pavement. Apply at a uniform rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m) of surface. Allow tack coat to cure undisturbed before paving.
 - 1. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- E. Machine place base and surface courses of hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness, when compacted.

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- F. Promptly correct surface irregularities in paving course behind paver. Remove excess material and fill depressions with hot-mix asphalt.
- G. Construct joints to ensure continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.
- H. Compact paving as soon as placed hot-mix asphalt will bear roller weight. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.
 - 1. Complete compaction before mix temperature cools to 185 deg F (85 deg C).
- I. Compact each hot-mix asphalt course to an average density of 96 percent of reference laboratory density according to ASTM D 1559, but not less than 94 percent nor greater than 100 percent, and to the following tolerances:
 - 1. Thickness: Base course, plus or minus 1/2 inch (13 mm); surface course, plus 1/4 inch (6 mm), no minus.
 - 2. Surface Smoothness: Base course, 1/4 inch (6 mm); surface course, 1/8 inch (3 mm).
- J. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt compacted by rolling to specified density and surface smoothness.
- K. Apply pavement-marking paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).
- L. Securely attach wheel stops into pavement with not less than 2 galvanized steel dowels embedded in precast concrete at one-third points. Firmly bond each dowel to wheel stop and to pavement.

END OF SECTION 025110

SECTION 027510 - CEMENT CONCRETE PAVEMENT

1.1 GENERAL

- A. Submittals: In addition to Product Data, submit design mixes for each concrete pavement mix.
 - 1. Submit material certificates signed by manufacturers certifying that each concrete material complies with requirements.
- B. Quality Assurance: Comply with ACI 301, "Specification for Structural Concrete," unless modified by the requirements of the Contract Documents.
 - 1. Installer Qualifications: An experienced installer who has completed pavement work 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.
 - 2. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

1.2 PRODUCTS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
- B. Steel Reinforcement Materials: As follows:
 - 1. Plain-Steel Welded Wire Fabric: ASTM A 185, flat sheets.
 - 2. Reinforcement Bars: ASTM A 615/A 615M, [Grade 60 \(Grade 420\)](#), deformed.
 - 3. Plain Steel Wire: ASTM A 82, as drawn.
 - 4. Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening steel reinforcement; manufactured according to CRSI's "Manual of Standard Practice"
- C. Concrete Materials: As follows:
 - 1. Portland Cement: ASTM C 150, Type I or II.
 - a. Fly Ash: ASTM C 618, Class F or C.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
 - 2. Aggregate: ASTM C 33, uniformly graded, from a single source.
 - 3. Water: ASTM C 94.
 - 4. Synthetic Fiber: Fibrillated or monofilament polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, [1/2 to 1 inch \(13 to 25 mm\)](#) long.
- D. Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other admixtures, as follows:
 - 1. Air-Entraining Admixture: ASTM C 260.
 - 2. Water-Reducing Admixture: ASTM C 494, Type A.
 - 3. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
 - 4. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.

5. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
 - E. Curing Materials: As follows:
 1. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.
 2. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
 3. Water: Potable.
 4. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 5. Clear Solvent-Borne Liquid-Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
 6. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
 - F. Related Materials: As follows:
 1. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.
 2. Coloring Agent: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.
 - G. Concrete Mixes: Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, with the following properties:
 1. Compressive Strength (28 Days): 3500 psi (24.1 MPa).
 2. Maximum Water-Cementitious Materials Ratio: 0.50.
 3. Slump Limit: 4 inches (100 mm).
 4. Air Content: 4.5 to 7.5 percent.
 - H. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd. (0.60 kg/cu. m).
 - I. Coloring Agent: Add coloring agent to mix according to manufacturer's written instructions.
 - J. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94.
 - K. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94 and ASTM C 1116.
 - L. Project-Site Mixing: Comply with requirements and measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.
- 1.3 EXECUTION
- A. Surface Preparation: Proof-roll prepared subbase, and remove loose material from surface.
 - B. Forms: Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations.
 - C. Reinforcement: Accurately position and support reinforcement, and secure against displacement. Set wire ties with ends directed into concrete.

1. Install welded wire fabric in lengths as long as practicable; lap at least one full mesh, and lace splices with wire.
- D. Joints: Locate and install construction, isolation, contraction, and expansion joints as indicated.
- E. Concrete Placement: Comply with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete. Place concrete in a continuous operation within planned joints or sections.
1. Moisten subbase to provide a uniform dampened condition at time concrete is placed.
 2. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping according to recommendations in ACI 309R.
 3. Screed and initial-float concrete surfaces with darby or bull float before excess moisture or bleed water appears on the surface.
 4. Protect concrete from cold or hot weather during mixing, placing, and curing.
- F. Evaporation Retarder: Apply to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- G. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surfaces to true planes with gaps below 10-foot- (3-m-) long, unlevelled straightedge not to exceed 1/4 inch (6 mm). Cut down high spots, and fill low spots. Refloat surface immediately to uniform granular texture.
1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
 2. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.
 3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch (1.6 to 3 mm) deep with a stiff-bristled broom, perpendicular to line of traffic.
- H. Curing: Begin curing after finishing concrete, but not before free water has disappeared from concrete surface. Cure concrete by one or a combination of the following methods:
1. Moisture cure concrete by water, continuous fog spray, continuously wet absorptive cover, or by moisture-retaining-cover curing. Keep surfaces continuously moist for not less than seven days.
 2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
- I. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet requirements in this Section.
- J. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement.
- K. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

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END OF SECTION 027510

SECTION 027640 - PAVEMENT JOINT SEALANTS

1.1 GENERAL

- A. Preconstruction Joint-Sealant-Substrate Tests: Submit substrate materials, representative of actual joint surfaces, to joint sealant manufacturer for laboratory testing of joint sealants for adhesion to primed and unprimed substrates and for compatibility with joint substrates and other joint-related materials.
- B. Submittals: In addition to Product Data, submit the following:
 - 1. Samples of each type and color of joint sealant required.
 - 2. Certified test reports for joint sealants evidencing compliance with requirements.

1.2 PRODUCTS

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by testing and field experience.
- B. Colors: Provide color indicated for exposed joint sealants or, if not indicated, as selected by Architect from manufacturer's full range for this characteristic.
- C. Cold-Applied Joint Sealants: Provide manufacturer's standard products complying with the following requirements:
 - 1. Single-Component Jet-Fuel-Resistant Urethane Sealant for Concrete: Single-component, pourable, coal-tar-modified, urethane formulation complying with ASTM C 920 for Type S; Grade P; Class 25; Uses T, M, and, as applicable to joint substrates indicated, O.
 - 2. Multicomponent Low-Modulus Sealant for Concrete and Asphalt: Proprietary formulation consisting of reactive petropolymer and activator components producing a pourable, self-leveling sealant.
- D. Joint-Sealant Backer Materials: Nonstaining; compatible with joint substrates, sealants, primers and other joint fillers; and approved for applications indicated by joint sealant manufacturer based on field experience and laboratory testing.
 - 1. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depths and prevent bottom-side adhesion of sealant.
- E. Primers: As recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from pre-construction joint-sealant-substrate tests and field tests.

1.3 EXECUTION

- A. General: Comply with joint sealant manufacturer's written instructions applicable to products and applications indicated.
- B. Elastomeric Sealant Installation Standard: Comply with ASTM C 1193.

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- C. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

END OF SECTION 027640

SECTION 033000 - CAST-IN-PLACE CONCRETE

1.1 GENERAL

- A. Submittals: In addition to Product Data, submit design mixes and the following for each concrete mix:
1. Shop Drawings detailing fabrication, bending, and placement.
 2. Material certificates signed by product manufacturers certifying that product complies with requirements.
- B. Quality Assurance: Comply with ACI 301, "Specification for Structural Concrete," and ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
1. Installer Qualifications: An experienced installer who has completed concrete Work 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.
 2. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

1.2 PRODUCTS

- A. Steel Reinforcement: As follows:
1. Reinforcing Bars: ASTM A 615/A 615M, **Grade 60 (Grade 420)**, deformed.
 2. Plain-Steel Wire: ASTM A 82, as drawn.
 3. Deformed-Steel Wire: ASTM A 496.
 4. Plain-Steel Welded Wire Fabric: ASTM A 185, flat sheets.
 5. Deformed-Steel Welded Wire Fabric: ASTM A 497, flat sheet.
- B. Concrete Materials: As follows:
1. Portland Cement: ASTM C 150, Type I or II.
 2. Aggregate: ASTM C 33, uniformly graded, from a single source.
 3. Water: ASTM C 94.
 4. Air-Entraining Admixture: ASTM C 260.
 5. Water-Reducing Admixture: ASTM C 494, Type A.
 6. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
 7. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
 8. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
 9. Synthetic Fiber: Fibrillated or monofilament polypropylene fibers engineered and designed for use in concrete, complying with ASTM C 1116, Type III, **1/2 to 1 inch (13 to 25 mm)** long.
- C. Related Materials: As follows:
1. Flexible Waterstops: Rubber, CE CRD-C 513, or PVC, CE CRD-C 572.
 2. Self-Expanding Strip Waterstops: Rectangular or trapezoidal strip, sodium bentonite or other hydrophylic material.
 3. Vapor Retarder: ASTM E 1745, Class C, not less than **7.8 mils (0.18 mm)** thick; or polyethylene sheet, ASTM D 4397, not less than **10 mils (0.25 mm)** thick.

4. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.
5. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
6. Epoxy-Bonding Adhesive: ASTM C 881, two-component epoxy resin, of class and grade to suit requirements.

D. Curing Materials: As follows:

1. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
2. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.
3. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
4. Clear, Solvent-Borne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
5. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
6. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
7. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

E. Concrete Mixes: Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, with the following properties:

1. Compressive Strength (28 Days): 3500 psi (24.1 MPa).
2. Slump: 4 inches (100 mm).
3. Air Content: 4.5 to 7.0 percent.

F. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1 lb/cu. yd. (0.60 kg/cu. m).

G. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.

H. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.

1.3 EXECUTION

- A. Design, construct, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.
- B. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
- C. Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place until concrete has achieved 28-day design compressive strength.

- D. Comply with [ACI 318 \(ACI 318M\)](#), ACI 301, and recommendations in ACI 347R for design, installation, and removal of shoring and reshoring.
- E. Vapor Retarder: Place, protect, and repair vapor-retarder sheets according to ASTM E 1643.
- F. Steel Reinforcement: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- G. Joints: Locate and install construction, isolation, and contraction joints.
- H. Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions.
- I. Concrete Placement: Deposit concrete continuously and avoid segregation. Deposit concrete in forms in horizontal layers no deeper than [24 inches \(600 mm\)](#), avoiding cold joints.
 - 1. Consolidate concrete with mechanical vibrating equipment.
 - 2. Screed and initial-float concrete floors and slabs using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
 - 3. Comply with ACI 306.1 for cold-weather concrete placement.
 - 4. Place concrete according to recommendations in ACI 305R when hot-weather conditions exist.
- J. Finish formed surfaces as follows:
 - 1. Apply rough-formed finish, defined in ACI 301, to concrete surfaces indicated or not exposed to public view.
 - 2. Apply smooth-formed finish, defined in ACI 301, to concrete surfaces indicated and exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
 - a. Do not apply rubbed finish to smooth-formed finish.
 - 3. Apply smooth-rubbed finish to smooth-formed finished concrete surfaces indicated or exposed to public view.
- K. Finishing Floors and Slabs: Comply with recommendations in ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces.
 - 1. Scratch Finish: Apply scratch finish, defined in ACI 301, to surfaces indicated and to surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, portland cement terrazzo, and other bonded cementitious floor finishes.
 - 2. Float Finish: Apply float finish, defined in ACI 301, to surfaces indicated, to surfaces to receive trowel finish, and to surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
 - 3. Trowel Finish: Apply a trowel finish to surfaces indicated and to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system.

- a. After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighthen until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - b. Finish and measure surface so gap at any point between concrete surface and an unlevelled freestanding 10-foot- (3.05-m-) long straightedge, resting on two high spots and placed anywhere on the surface, does not exceed the following:
 - 1) 1/4 inch (6.4 mm).
 - 2) 3/16 inch (4.8 mm).
 - 3) 1/8 inch (3.2 mm).
4. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.
 5. Broom Finish: Apply a broom finish to exterior concrete, brooming with fiber-bristle broom perpendicular to main traffic route, to platforms, steps, and ramps, and elsewhere as indicated.
- L. Concrete Protection and Curing: Protect concrete from excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.
1. Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause excessive moisture loss.
 2. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
 3. Cure formed and unformed concrete for at least seven days by moisture curing, moisture-retaining-cover curing, or curing compound.
 4. Cure and seal floors and slabs with a curing and sealing compound according to manufacturer's written instructions.
- M. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Tests shall be performed according to ACI 301.
- N. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

END OF SECTION 033000

SECTION 054000 - COLD-FORMED METAL FRAMING

1.1 GENERAL

- A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads without deflections greater than the following:
1. Exterior Load-Bearing Wall Framing: Horizontal deflection of 1/360 of the wall height.
 2. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/360 of the wall height.
 3. Exterior Non-Load-Bearing Curtain-Wall Framing: Horizontal deflection of 1/360 of the wall height.
- B. Submittals: In addition to Product Data, submit the following:
1. Shop Drawings showing layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
 2. Structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 3. Mill certificates signed by steel sheet producer or test reports from a qualified independent testing agency.
 4. Welder certificates.
 5. Research/Evaluation Reports: Evidence of cold-formed metal framing's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
- C. Quality Assurance: Comply with AISI's "Specification for the Design of Cold-Formed Steel Structural Members" for calculating structural characteristics of cold-formed metal framing.
1. Engineering Responsibility: Engage a qualified professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated to prepare design calculations, Shop Drawings, and other structural data.
 2. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
 3. Fire-Test-Response Characteristics: Where metal framing is part of a fire-resistance-rated assembly, provide framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - a. Fire-Resistance Ratings: Indicated by GA File Numbers in GA-600, "Fire Resistance Design Manual," or by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
 4. Comply with HUD's "Prescriptive Method for Residential Cold-Formed Steel Framing."

1.2 PRODUCTS

- A. Steel Sheet: ASTM A 653/A 653M, structural steel, G60 (Z180) zinc coating, Grade 33 (230) for minimum uncoated steel thickness of 0.0428 inch (1.09 mm) and less; 50 (340) for minimum uncoated steel thickness of 0.0538 inch (1.37 mm) and greater.

- B. Wall Framing: Manufacturer's standard steel studs, of web depths indicated, with stiffened flanges, complying with ASTM C 955, and as follows:
 - 1. Minimum Uncoated-Steel Thickness: 0.0538 inch (1.37 mm).
 - 2. Flange Width: 1-5/8 inches (41 mm).
 - 3. Section Properties: Refer to structural drawings.
 - 4. Track: Manufacturer's standard U-shaped steel track, unpunched, with straight flanges, complying with ASTM C 955, manufacturer's standard flange width, and minimum uncoated-steel thickness matching steel studs.
- C. Fabricate steel-framing accessories of the same material and finish used for framing members, with a minimum yield strength of 33,000 psi (230 MPa), of manufacturer's standard thickness and configuration, unless otherwise indicated.
- D. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123.
- E. Anchor Bolts: Refer to structural drawings.
- F. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
- G. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.
- H. Mechanical Fasteners: Corrosion-resistant-coated, self-drilling, self-threading steel drill screws.
- I. Galvanizing Repair Paint: [SSPC-Paint 20 or DOD-P-21035] [ASTM A 780].
- J. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

1.3 EXECUTION

- A. Grout bearing surfaces uniform and level to ensure full contact of bearing flanges or track webs on supporting concrete or masonry construction.
- B. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to ASTM C 1007, manufacturer's written recommendations, and requirements in this Section.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
 - 3. Install framing members in one-piece lengths.
 - 4. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed.
 - 5. Install insulation in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

6. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
- C. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of **1/8 inch in 10 feet (1:960)** and as follows:
1. Space individual framing members no more than plus or minus **1/8 inch (3 mm)** from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
- D. Load-Bearing Wall Installation: Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends. Squarely seat studs against webs of top and bottom tracks. Space studs as indicated, set plumb, align, and fasten both flanges of studs to top and bottom tracks.
1. Align studs vertically where wall-framing continuity is interrupted by floor framing. Where studs cannot be aligned, continuously reinforce track to transfer loads.
 2. Align floor and roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads.
 3. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.
 4. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
 5. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings.
 6. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
 7. Install horizontal bridging in stud system, spaced as indicated on Shop Drawings. Fasten at each stud intersection.
 8. Install miscellaneous framing and connections, including supplementary framing, blocking, bracing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.
- E. Non-Load-Bearing Curtain-Wall Installation: Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure. Space studs as indicated; set plumb, align, and fasten both flanges of studs to track, unless otherwise indicated.
1. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 2. Install horizontal bridging in curtain-wall studs, spaced in rows indicated on Shop Drawings but not more than **54 inches (1370 mm)** apart. Fasten at each stud intersection.
 3. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable curtain-wall-framing system.
- F. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

END OF SECTION 054000

SECTION 055000 - METAL FABRICATIONS

1.1 GENERAL

A. Submittals: In addition to Product Data, submit the following:

1. Shop Drawings detailing fabrication and erection.
2. Templates for anchor bolts.

1.2 PRODUCTS

A. General: Provide materials with smooth, flat surfaces without blemishes.

B. Ferrous Metals: As follows:

1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
2. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.
3. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless otherwise indicated.
4. Iron Castings: [ASTM A 47, Grade 32510 \(ASTM A 47M, Grade 22010\)](#) malleable iron or [ASTM A 48, Class 30 \(ASTM A 48M, Class 200\)](#) gray iron.
5. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either [ASTM A 47 \(ASTM A 47M\)](#) malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

C. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664 and compatible with finish paint systems indicated.

D. Fasteners: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.

F. Concrete Fill: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of [3000 psi \(20 MPa\)](#), unless otherwise indicated.

G. Fabrication, General: Use connections that maintain structural value of joined pieces. Shear and punch metals cleanly and accurately. Remove burrs.

1. Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove welding flux immediately. Finish exposed welds smooth and blended.
2. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes.
3. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.

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- H. Loose Bearing and Leveling Plates: Provide for steel items bearing on masonry or concrete. Drill plates to receive anchor bolts.
 - 1. Galvanize plates.
- I. Loose Steel Lintels: Fabricate from shapes and to sizes indicated.
- J. Shelf Angles: Fabricate to sizes indicated and for attachment to framing. Provide horizontally slotted holes to receive **3/4-inch (19-mm)** bolts, spaced not more than **6 inches (150 mm)** from ends and **24 inches (600 mm)** o.c.
 - 1. Galvanize shelf angles to be installed in exterior walls.
 - 2. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.
- K. Miscellaneous Steel Trim: Fabricate units with continuously welded joints and smooth exposed edges. Miter corners and use concealed splices where possible. Provide cutouts, fittings, and anchorages; coordinate assembly and installation with other work.
 - 1. Provide flush drop handles, made from same metal as plates, at each end of each removable section.
- L. Pipe Bollards: Fabricate from Schedule 40 steel pipe.
 - 1. Cap bollards with **1/4-inch- (6-mm-)** minimum steel plate.
 - 2. Fabricate bollards with **3/8-inch- (10-mm-)** thick steel baseplates drilled at all four corners for **3/4-inch (19-mm)** anchor bolts.
 - 3. Fabricate sleeves for bollard anchorage from steel pipe with **1/4-inch (6-mm)** thick steel plate welded to bottom of sleeve.
- M. Finish metal fabrications after assembly. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Shop prime ferrous-metal items not indicated to be galvanized.
 - 1. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
 - 2. Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

1.3 EXECUTION

- A. Installation, General: Provide anchorage devices and fasteners for securing metal fabrications to in-place construction. Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, with edges and surfaces level, plumb, and true.
 - 1. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
 - 2. Fit exposed connections accurately together. Weld connections, unless otherwise indicated. Do not weld, cut, or abrade galvanized surfaces.
- B. Set bearing and leveling plates on cleaned surfaces using wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts and pack with nonshrink, nonmetallic grout.

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- C. Anchor bollards in place with concrete footings. Support and brace bollards in position in footing excavations until concrete has been placed and cured.
- D. Fill bollards solidly with concrete, mounding top surface.
- E. Touch up shop paint after erection. Clean field welds, bolted connections, and abraded areas and paint with the same material as used for shop painting.

END OF SECTION 055000

SECTION 055210 - PIPE AND TUBE RAILINGS

1.1 GENERAL

- A. Structural Performance of Handrails and Railings: Comply with ASTM E 985, based on testing per ASTM E 894 and ASTM E 935.
- B. Structural Performance of Handrails and Railings: Capable of withstanding structural loads required by ASCE 7 without exceeding allowable design working stresses of materials involved.
- C. Structural Performance of Handrails and Railings: Capable of withstanding the following structural loads without exceeding allowable design working stresses of materials involved:
 - 1. Top Rail of Guards: Concentrated load of 200 lbf (890 N) applied at any point and in any direction, and uniform load of 50 lbf/ft. (730 N/m) applied horizontally and concurrently with uniform load of 100 lbf/ft. (1460 N/m) applied vertically downward. Concentrated and uniform loads need not be assumed to act concurrently.
 - 2. Handrails Not Serving As Top Rails: Concentrated load of 200 lbf (890 N) applied at any point and in any direction, and uniform load of 50 lbf/ft. (730 N/m) applied in any direction. Concentrated and uniform loads need not be assumed to act concurrently.
 - 3. Infill Area of Guards: Horizontal concentrated load of 200 lbf (890 N) applied to 1 sq. ft. (0.09 sq. m) at any point in system, including panels, intermediate rails, balusters, or other elements composing infill area. Load on infill need not be assumed to act concurrently with loads on top rails.
- D. Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- E. Submittals: In addition to Product Data, submit the following:
 - 1. Shop Drawings showing railing layout and details, with structural computations.
 - 2. Samples for each type of exposed finish required.
 - 3. Test reports from an independent testing agency indicating handrails and railings comply with ASTM E 985.

1.2 PRODUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Aluminum Pipe and Tube Railings:
 - a. Alumaguard.
 - b. Aluminum Tube Railings, Inc.
 - c. Architectural Art Mfg., Inc.
 - d. Blum: Julius Blum & Co., Inc.
 - e. Braun: J.G. Braun Co.
 - f. CraneVeyor Corp.
 - g. Hollaender Manufacturing Co.
 - h. Moultrie Manufacturing Co.
 - i. Newman Bros., Inc.
 - j. Sterling Fabricated Systems, Inc.

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- k. Superior Aluminum Products, Inc.
 - l. Thompson Fabricating Company.
 - m. Wagner: R & B Wagner, Inc.
2. Stainless-Steel Pipe and Tube Railings:
 - a. Alumaguard.
 - b. Architectural Art Mfg., Inc.
 - c. Blum: Julius Blum & Co., Inc.
 - d. CraneVeyor Corp.
 - e. KDI Paragon, Inc.
 - f. Stainless Fabricators, Inc.
 - g. Wagner: R & B Wagner, Inc.
 3. Steel Pipe and Tube Railings:
 - a. Humane Equipment Co.
 - b. Wagner: R & B Wagner, Inc.
- B. Aluminum: Alloy and temper recommended by aluminum producer and finisher for use and finish indicated, and with not less than the strength and durability of the alloy and temper designated below.
1. Extruded Bar and Tube: [ASTM B 221 \(ASTM B 221M\)](#), alloy 6063-T5/T52.
 2. Extruded Structural Pipe and Tube: ASTM B 429, alloy 6063-T6.
 3. Drawn Seamless Tube: [ASTM B 210 \(ASTM B 210M\)](#), alloy 6063-T832.
 4. Plate and Sheet: [ASTM B 209 \(ASTM B 209M\)](#), alloy 6061-T6.
 5. Die and Hand Forgings: [ASTM B 247 \(ASTM B 247M\)](#), alloy 6061-T6.
 6. Castings: ASTM B 26/B 26M, alloy A356-T6.
- C. Stainless Steel: Grade or type designated below:
1. Tubing: ASTM A 554, Grade MT 304.
 2. Pipe: ASTM A 312/A 312M, Grade TP 304.
 3. Castings: ASTM A 743/A 743M, Grade CF 8 or CF 20.
 4. Plate: ASTM A 666, Type 304.
 5. Tubing: ASTM A 554, Grade MT 316L.
 6. Pipe: ASTM A 312/A 312M, Grade TP 316L.
 7. Castings: ASTM A 743/A 743M, Grade CF 8M or CF 3M.
 8. Plate: ASTM A 666, Type 316L.
- D. Steel and Iron: Provide the form indicated, complying with the following:
1. Steel Pipe: ASTM A 53, Type F or Type S, Grade A, standard weight (Schedule 40), unless another grade and weight are required by structural loads.
 - a. Black finish, unless otherwise indicated.
 - b. Galvanized finish for exterior installations and where indicated.
 2. Steel Tubing: Cold-formed steel tubing, ASTM A 500, Grade A, unless another grade is required by structural loads.
 3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 4. Iron Castings: Malleable iron complying with [ASTM A 47, Grade 32510 \(ASTM A 47M, Grade 22010\)](#).

5. Iron Castings: Gray iron complying with [ASTM A 48, Class 30](#) ([ASTM A 48M, Class 200](#)).
- E. Brackets, Flanges, and Anchors: Cast or formed metal of same material and finish as supported rails.
- F. Welding Electrodes and Filler Metal: 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.
- G. Fasteners: Same basic metal as fastened metal; concealed unless otherwise indicated or unavoidable and standard with systems indicated.
- H. 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 four times the load imposed when installed in concrete, as determined per ASTM E 488.
- I. Shop Primers: Provide primers to comply with applicable requirements in Division 9 Section "Painting."
- J. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; with good resistance to corrosion; and compatible with finish paint systems indicated.
- K. Shop Primer for Galvanized Steel: Zinc-dust, zinc-oxide primer formulated for priming zinc-coated steel and for compatibility with finish paint systems indicated, and complying with SSPC-Paint 5.
- L. Grout and Anchoring Cement: Premixed, nonshrink, nonmetallic grout complying with ASTM C 1107 or erosion-resistant, nonshrink, anchoring cement; recommended by manufacturer for use indicated.
- M. Fabrication, General: Fabricate to design, dimensions, and details indicated, but not less than that required to support structural loads.
 1. Form changes in direction of railing members as follows:
 - a. By bending.
 - b. By mitering.
 - c. By inserting prefabricated flush-elbow fittings.
 - d. By any method indicated above, applicable to change in direction involved.
 2. Form curves by bending in jigs to produce uniform curvature without buckling, twisting, cracking, or otherwise deforming exposed surfaces.
 3. Welded Connections: Connect handrail and railing members by welding. Cope and weld or use welded-in fittings. Weld connections continuously.
 4. Nonwelded Connections: Connect handrail and railing members with concealed mechanical fasteners and fittings.
 - a. Fabricate splice joints for field connection using an epoxy structural adhesive.
 5. Welded Connections for Aluminum Pipe: Connect handrail and railing members with concealed internal welds, using manufacturer's standard system of sleeve and socket fittings.

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6. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to connect handrails and railings to other work.
 - a. For galvanized handrails and railings, provide galvanized brackets, flanges, fittings, and anchors.
 7. Close exposed ends of handrail and railing members with prefabricated end fittings.
 8. Provide wall returns at ends of wall-mounted handrails.
- T. Shop-Primed Galvanized Finish: Hot-dip galvanize after fabrication to comply with ASTM A 123, clean, treat with metallic-phosphate process, and apply primer.
- U. Shop-Primed Steel Finish: Prepare to comply with SSPC-SP 7, "Brush-off Blast Cleaning" and apply primer.

1.3 EXECUTION

- A. Installation, General: Perform cutting, drilling, and fitting required to install handrails and railings. Set units accurately in location, alignment, and elevation.
1. Set posts plumb within a tolerance of **1/16 inch in 3 feet (2 mm in 1 m)**.
 2. Align rails so variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed **1/4 inch in 12 feet (5 mm in 3 m)**.
- C. Anchor posts in concrete by inserting into formed or core-drilled holes and grouting annular space.
- F. Attach handrails to wall with wall brackets.
1. For wood stud partitions, use hanger or lag bolts set into wood backing between studs.
 2. For steel-framed gypsum board assemblies, use hanger or lag bolts set into wood backing between studs or fasten to steel framing or concealed reinforcements using self-tapping screws of size and type required to support structural loads.
- G. Touchup Painting: Clean field welds, bolted connections, and abraded areas and paint with same material used for shop painting.
- H. Galvanizing Repair: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055210

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SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1..1 RELATED DOCUMENTS:

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

1..2 SUMMARY:

- A. Types of work in this section include rough carpentry for:
 - 1. Wood framing including exterior walls.
 - 2. Timbers for posts and beams.
 - 3. Wood grounds, nailers, and blocking.
 - 4. Wood furring.
 - 5. Sheathing.
- B. Prefabricated wood trusses are specified in another Division-6 section.
- C. Interior walls shall be formed using light gauge metal framing.

1..3 DEFINITIONS:

- A. Rough carpentry includes carpentry work not specified as part of other sections and which is generally not exposed, except as otherwise indicated.

1..4 SUBMITTALS:

- A. Material Certificates: Where dimensional lumber is provided to comply with minimum allowable unit stresses, submit listing of species and grade selected for each use, and submit evidence of compliance with specified requirements. Compliance may be in form of a signed copy of applicable portion of lumber producer's grading rules showing design values for selected species and grade. Design values shall be as approved by the Board or Review of American Lumber Standards Committee.

1..5 PRODUCT HANDLING:

- A. Delivery and Storage: Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber as well as plywood and other panels; provide for air circulation within and around stacks and under temporary covering including polyethylene and similar materials.
 - 1. For lumber and plywood pressure treated with waterborne chemicals, sticker between each course to provide air circulation.

1..6 PROJECT CONDITIONS:

- A. Coordination: Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow attachments of other work.

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PART 2 - PRODUCTS:

2..1 LUMBER, GENERAL:

- A. Lumber Standards: Manufacture lumber to comply with PS 20 "American Softwood Lumber Standards" and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.
- B. Inspection Agencies: Inspection agencies and the abbreviations used to reference with lumber grades and species include the following:
 - 1. RIS - Redwood Inspection Service.
 - 2. NLGA - National Lumber Grades Authority (Canadian).
 - 3. SPIB - Southern Pine Inspection Bureau.
 - 4. WCLIB - West Coast Lumber Inspection Bureau.
 - 5. WWPA - Western Wood Products Association.
- C. Grade Stamps: Factory-mark each piece of lumber 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 mill.
 - 1. For exposed lumber apply grade stamps to ends or back of each piece, or omit grade stamps entirely and issue certificate of grade compliance from inspection agency in lieu of grade stamp.
- D. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified for each use.
 - 1. Provide dressed lumber, S4S, unless otherwise indicated.
 - 2. Provide seasoned lumber with 19 percent maximum moisture content at time of dressing and shipment for sizes 2" or less in nominal thickness, unless otherwise indicated.
 - 3. Provide lumber with 15 percent maximum moisture content at time of dressing and shipment for sizes 2" or less in nominal thickness, unless otherwise indicated.

2..2 DIMENSION LUMBER:

- A. For light framing provide "Stud" or "Standard" grade lumber for stud framing, (2" to 4" thick, 2" to 6" wide, 10' and shorter) and "Standard" grade for other light framing (2" to 4" thick, 2" to 4" wide), any species.
- B. For light framing (2" to 4" thick, 2" to 4" wide), provide the following grade and species:
 - 1. Construction grade.
 - 2. Standard grade.
 - 3. Utility grade.
 - 4. Any species of specified grade.
 - 5. Any species graded under WWPA or WCLIB rules.
 - 6. Southern Pine graded under SPIB rules.
 - 7. Spruce-Pine-Fir graded under NLGA rules.
- C. For structural light framing (2" to 4" thick, 2" to 4" wide), provide the following grade and species:
 - 1. Select structural grade.
 - 2. No. 1 grade.

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3. No. 2 grade.
4. No. 3 grade.
5. Any species of specified grade.
6. Same species as indicated for structural framing grade below.

D. For structural framing (2" to 4" thick, 5" and wider), provide the following grade and species:

1. Select Structural grade.
2. No. 1 grade.
3. No. 2 grade.
4. No. 3 grade.
5. Any species of specified grade.
6. Douglas Fir or Douglas-Fir-Larch graded, respectively, under WCLIB or WWPA rules.
7. Any species and grade which meets or exceeds the following values:
 - a. Fb (minimum extreme fiber stress in bending); 875 psi.
 - b. E (minimum modulus of elasticity); 1,600,000 psi.

2..4 BOARDS:

- A. Exposed Boards: Where boards will be exposed in the finished work, provide the following:
1. Moisture Content: 19 percent maximum, "S-DRY".
 2. Moisture Content: 15 percent maximum, "MC-15".
 3. Where transparent or natural finish or no finish is indicated, provide Redwood, Select Heart Grade (RIS).
 4. Where painted finish is indicated, provide No. 1 Boards per SPIB rules, select Merchantable Boards per WCLIB rules or No. 2 Common Boards & Better per WWPA rules.
- B. Concealed Boards: Where boards will be concealed by other work, provide lumber of 19 percent maximum moisture content (S-DRY) and of following species and grade:
1. Redwood Construction Common per RIS rules, Southern Pine No. 2 Boards per SPIB rules, or any species graded Construction Boards per WCLIB or WWPA rules,
 2. Redwood Merchantable per RIS rules, Southern Pine No. 2 Boards per SPIB rules, or any species graded Standard or No. 3 Common Boards per WCLIB or WWPA rules.
- C. Board Sizes: Provide sizes indicated or, if not indicated (for sheathing, subflooring and similar uses), provide 1" x 8" boards.

2..5 MISCELLANEOUS LUMBER:

- A. Provide wood for support or attachment of other work including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping and similar members. Provide lumber of sizes indicated, worked into shapes shown, and as follows:
- B. Moisture content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.
- C. Grade: Standard Grade light framing size lumber of any species or board size lumber as required. No. 3 Common or Standard grade boards per WCLIB or WWPA rules or No. 3 boards per SPIB rules.

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2..6 CONSTRUCTION PANELS:

- A. Construction Panel Standards: Comply with PS 1 "U.S. Product Standard for Construction and Industrial Plywood" for plywood panels and, for products not manufactured under PS 1 provisions, with American Plywood Association (APA) "Performance Standard and Policies for Structural-Use Panels", Form No. E445.
- B. Trademark: Factory-mark each construction panel with APA trademark evidencing compliance with grade requirements.
- C. Concealed APA Performance-Rated Panels: Where construction panels will be used for the following concealed types of applications, provide APA Performance-Rated Panels complying with requirements indicated for grade designations, span rating, exposure durability classification, edge detail (where applicable) and thickness.
 - 1. Wall Sheathing: APA RATED SHEATHING.
 - a. Exposure Durability Classification: EXTERIOR
 - b. Span Rating: As required to suit stud spacing indicated.
 - 2. Roof Sheathing: APA RATED SHEATHING.
 - a. Exposure Durability Classification: EXTERIOR
 - b. Span Rating: As required to suit rafter spacing indicated.
- D. Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant treated plywood panels with grade designation, APA C-D PLUGGED INT with exterior glue, in thickness indicated, or, if not otherwise indicated, not less than 15/32".

2..8 MISCELLANEOUS MATERIALS:

- A. Fasteners and Anchorages: Provide size, type, material and finish as indicated and as recommended by applicable standards, complying with applicable Federal Specifications for nails, staples, screws, bolts, nuts, washers and anchoring devices. Provide metal hangers and framing anchors of the size and type recommended by the manufacturer for each use including recommended nails.
 - 1. Where rough carpentry work is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners and anchorages with a hot-dip zinc coating (ASTM A 153).
- B. Building Paper: ASTM D 226, Type I; asphalt saturated felt, non-perforated, 15-lb. type.
- C. Sill Sealer Gaskets: Glass fiber resilient insulation fabricated in strip form for use as a sill sealer; 1" nominal thickness compressible to 1/32"; selected from manufacturer's standard widths to suit width of sill members indicated; in rolls of 50' or 100' in length.

2..9 WOOD TREATMENT BY PRESSURE PROCESS:

- A. Preservative Treatment: Where lumber or plywood is indicated as "Trt-Wd" or "Treated", or is specified herein to be treated, comply with applicable requirements of AWPB Standards C2 (Lumber) and C9 (Plywood) and of AWPB Standards listed below. Mark each treated item with the AWPB Quality Mark Requirements.
 - 1. Pressure-treat above-ground items with water-borne preservatives to comply with AWPB LP-2. After treatment, kiln-dry lumber and plywood to a maximum moisture content, respectively, of

19 percent and 15 percent. Treat indicated items and the following:

- a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers and waterproofing.
 - b. Wood sills, sleepers, blocking, furring, stripping and similar concealed members in contact with masonry or concrete.
 - c. Wood framing members less than 18" above grade.
 - d. Wood floor plates installed over concrete slabs directly in contact with earth.
2. Pressure-treat the following with water-borne preservatives for ground contact use complying with AWPB LP-22:
 - a. Wood members in contact with ground.
 - b. Wood members in contact with fresh water.
 3. Complete fabrication of treated items prior to treatment, where possible. If cut after treatment, coat cut surfaces with heavy brush coat of same chemical used for treatment and to comply with AWPA M4. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

PART 3 - EXECUTION

3..1 INSTALLATION, GENERAL:

- A. Discard units of material with defects which might impair quality of work, and units which are too small to use in fabricating work with minimum joints or optimum joint arrangement.
- B. Set carpentry work to required levels and lines, with members plumb and true and cut and fitted.
- C. Securely attach carpentry work to substrate by anchoring and fastening as shown and as required by recognized standards.
- D. Countersink nail heads on exposed carpentry work and fill holes.
- E. Use common wire nails, except as otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; predrill as required.

3..2 WOOD GROUNDS, NAILERS, BLOCKING AND SLEEPERS:

- A. Provide wherever shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.
- B. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.
- C. Provide permanent grounds of dressed, preservative treated, key-bevelled lumber not less than 1-1/2" wide and of thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.

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3.3 WOOD FRAMING, GENERAL:

- A. Provide framing members of sizes and on spacings shown, and frame openings as shown, or if not shown, comply with recommendations of "Manual for House Framing" of National Forest Products Association (N.F.P.A.). Do not splice structural members between supports.
- B. Anchor and nail as shown, and to comply with "Recommended Nailing Schedule" of "Manual for House Framing" and "National Design Specifications for Wood Construction" published by N.F.P.A.
- C. Firestop concealed spaces of wood framed walls and partitions at each floor level and at the ceiling line of the top story. Where firestops are not automatically provided by the framing system used, use closely-fitted wood blocks of nominal 2" thick lumber of the same width as framing members.

3.4 STUD FRAMING:

- A. General: Provide stud framing of size and spacing indicated or, if not otherwise indicated, of the following sizes and spacings. Arrange studs so that wide face of stud is perpendicular to direction of wall or partition and narrow face is parallel. Provide single bottom plate and double top plates using 2" thick members with widths equaling that of studs; except single top plate may be used for non-load-bearing partitions. Nail or anchor plates to supporting construction.
 - 1. For exterior walls provide 2" x 6" wood studs.
 - 2. For interior partitions and walls provide 2" x 4" wood studs spaced 16" o.c.
- B. Construct corners and intersections with not less than 3 studs. Provide miscellaneous blocking and framing as shown and as required for support of facing materials, fixtures, specialty items and trim.
 - 1. Provide continuous horizontal blocking row at mid-height of single-story partitions over 8' high and at midpoint of multi-story partitions, using 2" thick members of same width as wall or partitions.
- C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Set headers on edge and support on jamb studs.
 - 1. For non-bearing partitions, provide double-jamb studs and headers not less than 4" deep for openings 3' and less in width, and not less than 6" deep for wider openings.
 - 2. For load-bearing partitions, provide double-jamb studs for openings 6' and less in width, and triple-jamb studs for wider openings. Provide headers of depth shown, or if not shown, provide as recommended by N.F.P.A. "Manual for House Framing".
- D. Provide diagonal bracing in stud framing of exterior walls, except as otherwise indicated. Brace both walls at each external corner, full story height, at a 45 degree angle, using either a let-in 1 x 4 or 2 x 4 blocking or metal diagonal bracing. Omit bracing where following types of sheathing are indicated.
 - 1. Plywood sheathing or corner bracing, 4' wide panels vertically.
 - 2. Gypsum sheathing, 4' panels vertically.
 - 3. Fiberboard sheathing, intermediate type, 4' panels vertically.
 - 4. Diagonal board sheathing.

3.6 RAFTER AND CEILING JOIST FRAMING:

- A. Ceiling Joists: Provide member size and spacing shown, and as previously specified for floor joist framing. Face nail to ends of parallel rafters.
 - 1. Where principal ceiling joists are at right angles to rafters, frame as indicated with additional

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short joists from wall plate to first joist; nail to ends of rafters and to top plate and nail to long joists or anchor with framing anchors or metal straps. Provide 1 x 8 or 2 x 4 stringers spaced 4' o.c. crosswise over principal ceiling joists.

- B. Rafters: Provide member size and spacing shown. Notch to fit exterior wall plates and toe nail or use special metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing (if any), and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.
 - 1. At valleys, provide valley rafter of size shown, or if not shown, provide rafter twice as thick as regular rafters and 2" deeper. Bevel ends of jack rafters for full bearing against valley rafter.
 - 2. At hips, provide hip rafters of size shown, or if not shown, provide of same thickness as regular rafters and 2" deeper. Bevel ends of jack rafters for full bearing against hip rafters.
- C. Provide collar beams (ties) as shown, or if not shown, provide 1" x 6" boards between every third pair of rafters. Locate below ridge member, one-third of distance to ceiling joints. Cut ends to fit slope and nail to rafters.
- D. Provide special framing as shown of eaves, overhangs, dormers and similar conditions, if any.

END OF SECTION 061000.

SECTION 064020 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1..1 RELATED DOCUMENTS

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

1..2 SUMMARY

- A. This Section includes the following:
 - 1. Interior standing and running trim and rails.
 - 2. Laminate clad cabinets (plastic-covered casework).
 - 3. Cabinet tops (Laminate and solid surface countertops).
 - 4. Interior door frames (jambs).
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 6 Section "Rough Carpentry" for furring, blocking, and other carpentry work that is not exposed to view.
 - 2. Division 9 Section "Painting" for final finishing of installed architectural woodwork.

1..3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data for each type of product and process specified in this section and incorporated into items of architectural woodwork during fabrication, finishing, and installation.
- C. Shop drawings showing location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
- D. Samples for verification purposes of the following:
 - 1. Lumber with or for transparent finish, 50 square inches, for each species and cut, finished on one side and one edge.
 - 2. Lumber and panel products with factory-applied opaque finish, 8- 1/2 inches by 11 inches for panels and 50 square inches for lumber, for each finish system and color, with one half of exposed surface finished.
 - 3. Laminate clad panel products, 8-1/2 inches, by 11 inches for each type, color, pattern, and surface finish, with separate samples of unfaced panel product used for core. PROVIDE EDGE BAND ON SUBMITTED PANEL.
 - 4. Corner pieces as follows:
 - a. Cabinet front frame joints between stiles and rail as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
 - b. Miter joints for standing trim.
 - 5. Exposed cabinet hardware, one unit of each type and finish.
- E. Product certificates signed by woodwork manufacturer certifying that products comply with specified requirements.

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- F. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, and other information specified.

1..4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firm experienced in successfully producing architectural woodwork similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.
- B. Single-Source Manufacturing and Installation Responsibility: Engage a qualified Manufacturer to assume undivided responsibility for woodwork specified in this section, including fabrication, finishing, and installation.
- C. Installer Qualifications: Arrange for installation of architectural woodwork by a firm that can demonstrate successful experience in installing architectural woodwork items similar in type and quality to those required for this project.
- D. AWI Quality Standard: Comply with applicable requirements of "Architectural Woodwork Quality Standards" published by the Architectural Woodwork Institute (AWI) except as otherwise indicated.
- E. Hardware Coordination: Distribute copies of approved scheduled for cabinet hardware specified in Division 8 Section "Finish Hardware" to manufacturer of architectural woodwork; coordinate cabinet shop drawings and fabrication with hardware requirements.

1..5 DELIVERY, STORAGE, AND HANDLING

- A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.
- B. Do not deliver woodwork until painting, wet work, grinding, and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified in "Project Conditions."

1..6 PROJECT CONDITIONS

- A. Environmental Conditions: Obtain and comply with Woodwork Manufacturer's and Installer's coordinated advice for optimum temperature and humidity conditions for woodwork during its storage and installation. Do not install woodwork until these conditions have been attained and stabilized so that woodwork is within plus or minus 1.0 percent of optimum moisture content from date of installation through remainder of construction period.
- B. Field Measurements: Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before manufacturing woodwork; show recorded measurements on final shop drawings. Coordinate manufacturing schedule with construction progress to avoid delay of Work.
 - 1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with manufacture of woodwork without field measurements. Coordinate other construction to ensure that actual dimensions correspond to guaranteed dimensions.

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PART 2 - PRODUCTS

2..1 HIGH PRESSURE DECORATIVE LAMINATE MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide high pressure decorative laminates or solid surface materials as required by Drawings.

2..2 MATERIALS

- A. General: Provide materials that comply with requirements of the AWI woodworking standard for each type of woodwork and quality grade indicated and, where the following products are part of woodwork, with requirements of the referenced product standards, that apply to product characteristics indicated:
 - 1. Hardboard: ANSI/AHA A135.4
 - 2. High Pressure Laminate: NEMA LD 3.
 - 3. Medium Density Fiberboard: ANSI A208.2.
 - 4. Particleboard: ANSI A208.1
 - 5. Softwood Plywood: PS 1.
 - 6. Formaldehyde Emission Levels: Comply with formaldehyde emission requirements of each voluntary standard referenced below:
 - a. Particleboard: NPA 8.
 - b. Medium Density Fiberboard: NPA 9.
 - c. Hardwood Plywood: HPMA FE.

2..3 FABRICATION, GENERAL

- A. Wood Moisture Content: Comply with requirements of referenced quality standard for moisture content of lumber in relation to relative humidity conditions existing during time of fabrication and in installation areas.
- B. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Corners of cabinets and edges of solid wood (lumber) members less than 1 inch in nominal thickness: 1/16 inch.
 - 2. Edges of rails and similar members more than 1 inch in nominal thickness: 1/8 inch.
- C. Complete fabrication, including assembly, finishing, and hardware application, before shipment to project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- D. Factory-cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Smooth edges of cutouts and, where located in countertops and similar exposures, seal edges of cutouts with a water-resistant coating.

2..4 STANDING AND RUNNING TRIM AND RAILS FOR TRANSPARENT FINISH

- A. Quality Standard: Comply with AWI Section 300.

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- B. Backout or groove backs of flat trim members and kerf backs of other wide flat members, except for members with ends exposed in finished work.
- C. Assemble casings in plant except where limitations of access to place of installation require field assembly.
- D. Grade: Premium.
- E. Lumber Species: Clear Sliced Maple.

2..5 LAMINATE CLAD CABINETS (PLASTIC-COVERED CASEWORK)

- A. Quality Standard: Comply with AWI Section 400 and its Division 400B "Laminate Clad Cabinets."
- B. Grade: Custom.
- C. AWI Type of Cabinet Construction: Reveal overlay.
- D. Laminate Cladding: High pressure decorative laminate complying with the following requirements:
 - 1. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - a. Teller Pods, Break Room, Admin Room Open Office: Color by Architect/Owner. (See Finish List within this specification)
 - 2. Laminate Grade for Exposed Surfaces: Provide laminate cladding complying with the following requirements for type of surface and grade.
 - a. Horizontal Surfaces Other Than Tops: GP-50 (0.050-inch nominal thickness).
 - b. Postformed Surfaces: PF-42 (0.042-inch nominal thickness).
 - c. Vertical Surfaces: GP-50 (0.050-inch nominal thickness).
 - d. Edges: 3 millimeter PVC to match architect's selection as submitted by cabinet shop.
 - 3. Semiexposed Surfaces: Provide surface materials indicated below:
 - a. High pressure laminate, GP-28.
- E. Provide dust panels of 1/4-inch plywood or tempered hardboard above compartments and drawers except where located directly under tops.

2..6 CABINET HARDWARE AND ACCESSORY MATERIALS

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 8 Section "Finish Hardware."
- B. Cabinet Hardware: Provide concealed hinges at all cabinet door panels. Provide full extension commercial grade drawer glides. Residential quality glides not permitted for use.
- C. Hardware Standard: Comply with ANSI/BHMA A156.9 "American National Standard for Cabinet Hardware" for items indicated by reference to BHMA numbers or referenced to this standard.
- D. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for BHMA code number indicated.

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1. Satin Chromium Plated, Brass or Bronze Base: BHMA 626.
 2. Satin Stainless Steel, Stainless Steel Base: BHMA 630.
- E. For concealed hardware provide manufacturer's standard finish that complies with product class requirements of ANSI/BHMA A156.9.
- 2..7 ARCHITECTURAL CABINET TOPS (COUNTERTOPS)
- A. Quality Standard: Comply with AWI Section 400 and its Division 400C.
- B. Type of Top: High pressure decorative laminate complying with the following:
1. Grade: Custom.
 2. Laminate Cladding for Horizontal Surface: High pressure decorative laminate as follows:
 - a. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - b. Grade: GP-50 (0.050-inch nominal thickness).
 3. Edge Treatment: Waterfall edge for laminate or as indicated on drawings.
- 2..8 SOLID SURFACE COUNTERTOPS
- A. Manufacturer: Corian Quartz – Space Black utilizing 3/4" thickness at all tops and 3/4" at vertical surfaces. Counter edge thickness to be built up to 1 1/2" thick.
- 2..9 INTERIOR DOOR FRAMES FOR TRANSPARENT FINISH
- A. Quality Standard: Comply with AWI Section 900B.
- B. Grade: Premium.
- C. Lumber Species: n/a
- D. Lumber Species: Match species and cut indicated for other types of transparent finished architectural woodwork located in same areas of building unless otherwise indicated.
- 2..10 FASTENERS AND ANCHORS
- A. Screws: Select material, type, size, and finish required for each use. Comply with FS FF-S-111 for applicable requirements.
1. For metal framing supports, provide screws as recommended by metal framing manufacturer.
- B. Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.
- C. Anchors: Select material, type, size, and finish required by each substrate for secure anchorage. Provide nonferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts and anchors, as required, to be set into concrete or masonry work for subsequent woodwork anchorage.

2..11 FACTORY FINISHING OF INTERIOR ARCHITECTURAL WOODWORK

- A. Quality Standard: Comply with AWI Section 1500 unless otherwise indicated.
- B. General: The entire finish of interior architectural woodwork is specified in this section, regardless of whether factory applied or applied after installation.
 - 1. Factory Finishing: To the greatest extent possible, finish architectural woodwork at factory. Defer only final touch-up, cleaning, and polishing until after installation.
- C. General: The primary and prefinishing (if any) of interior architectural woodwork required to be performed at factory is specified in this section. Refer to Division 9 Section "Painting" for final finishing of installed architectural woodwork and for material and application requirements of prime coats for woodwork not specified to receive final finish in this section.
- D. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces and similar preparations for finishing of architectural woodwork, as applicable to each unit of work.

PART 3 - EXECUTION

3..1 PREPARATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas before installing.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

3..2 INSTALLATION

- A. Quality Standard: Install woodwork to comply with AWI Section 1700 for same grade specified in Part 2 of this section for type of woodwork involved.
- B. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8 inch in 8'-0" for plumb and level (including tops) and with no variations in flushness of adjoining surfaces.
- C. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.
- D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fastener heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.
- E. Standing and Running Trim and Rails: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to the greatest extent possible. Stagger joints in adjacent and related members. Cope at returns and miter at corners.
- F. Cabinets: Install without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated.

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- G. Tops: Anchor securely to base units and other support systems as indicated.
- H. Complete the finishing work specified in this section to whatever extent not completed at shop or before installation of woodwork.
- I. Refer to the Division 9 sections for final finishing of installed architectural woodwork.

3.3 ADJUSTMENT AND CLEANING

- A. Repair damaged and defective woodwork where possible to eliminate defects functionally and visually; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean woodwork on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.4 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensures that woodwork is being without damage or deterioration at time of Substantial Completion.

END OF SECTION 064020

SECTION 072100 - BUILDING INSULATION

1.1 GENERAL

- A. Submittals: Product Data for each type of insulation product specified.
- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated as determined by testing identical products per ASTM E 84, ASTM E 119, or ASTM E 136 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1.2 PRODUCTS

- A. General: Provide insulating materials that comply with requirements and with referenced standards.
 - 1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.
- B. Extruded-Polystyrene Board Insulation: ASTM C 578 for type indicated below:
 - 1. Type IV, 1.60-lb/cu. ft. (26-kg/cu. m) minimum density.
 - 2. Clip to be installed at curtain wall to prevent contact with exterior panel surface (if required).
 - 3. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indices of 75 and 450, respectively.
- C. Polyisocyanurate Board Insulation: Rigid, cellular polyisocyanurate thermal insulation faced on both sides with aluminum foil to comply with requirements indicated below:
 - 1. Federal Standard: FS HH-I-1972/1, Class 1 (nonreinforced core) or 2 (reinforced core).
 - 2. ASTM Standard: ASTM C 1289, Type I, Class 1 or 2.
 - 3. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indices of 75 and 450, respectively, based on tests performed on unfaced core on thicknesses up to 4 inches (101 mm).
 - 4. Thermal Resistivity: 7.2 deg F x h x sq. ft./Btu x in. at 75 deg F (50 K x m/W at 24 deg C).
- D. Unfaced, Flexible Glass-Fiber Board Insulation: ASTM C 612, Type IA or ASTM C 553, Types I, II, and III.
 - 1. Nominal Density: Not less than 1.5 lb/cu. ft. (24 kg/cu. m) nor more than 1.65 lb/cu. ft. (26 kg/cu. m).
 - 2. Thermal Resistivity: 4.13 deg F x h x sq. ft./Btu x in. at 75 deg F (28.6 K x m/W at 24 deg C).
 - 3. Surface-Burning Characteristics: Smoke-developed indices of 25 and 50, respectively.
- E. Faced Mineral-Fiber Blanket Insulation: ASTM C 665, Type III, Class A (blankets with reflective vapor-retarder membrane facing and flame spread of 25 or less); with foil-scrim-kraft, foil-scrim, or foil-scrim-polyethylene vapor-retarder membrane on 1 face.

1. Mineral-Fiber Type: Fibers manufactured from glass, slag wool, or rock wool.
- F. Cellulosic-Fiber Loose-Fill Insulation: Recycled cellulosic-fiber loose-fill-type insulation complying with ASTM C 739, chemically treated for flame-resistance, processing, and handling characteristics.
- G. Fire-Retardant, Reinforced-Polyethylene Vapor Retarders: 2 outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either a nonwoven grid of nylon cord or polyester scrim and weighing not less than 22 lb/1000 sq. ft. (10 kg/100 sq. m), with maximum permeance rating of 0.1317 perm (7.53 ng/Pa x s x sq. m) and flame-spread and smoke-developed indices of not more than 5 and 75, respectively.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. DURA-SKRIM 2FR; Raven Industries, Inc.
 - b. Griffolyn T-55 FR; Reef Industries, Inc., Griffolyn Div.
- H. Foil-Polyester Film Vapor Retarder: 2 layers of 0.5-mil- (0.013-mm-) thick polyester film laminated to an inner layer of 1-mil- (0.025-mm-) thick aluminum foil, with maximum water-vapor transmission rate in flat condition of 0.0 g/h x sq. m and with maximum flame-spread and smoke-developed indices of 15 and 5, respectively.
1. Product: Subject to compliance with requirements, provide the following:
 - a. Alumiseal Zero Perm; Alumiseal Corporation.
- I. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.
- J. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.
- K. Protection Board: Premolded, semirigid asphalt/fiber composition board, 1/4 inch (6 mm) thick, formed under heat and pressure, standard sizes.
- L. Eave Ventilation Troughs: Preformed rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.
- M. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation, of thickness indicated, securely in position indicated with self-locking washer in place; and complying with the following requirements:
1. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch (0.762 mm) thick by 2 inches (50 mm) square.
 2. Spindle: Copper-coated low carbon steel, fully annealed, 0.105 inches (2.67 mm) in diameter, length to suit depth of insulation indicated.
- N. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle, capable of holding insulation securely in position indicated with self-locking washer in place, and complying with the following requirements:
1. Angle: Formed from 0.030-inch- (0.762-mm-) thick, perforated, galvanized carbon-steel sheet with each leg 2 inches (50 mm) square.

2. Spindle: Copper-coated low carbon steel, fully annealed, 0.105 inches (2.67 mm) in diameter, length to suit depth of insulation indicated.
- O. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) square or in diameter.
 1. Where spindles will be exposed to human contact after installation, protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap.
- P. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space of dimension indicated between face of insulation and substrate to which anchor is attached.
 1. Air Space: Re: Drawings.
- Q. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

1.3 EXECUTION

- A. Installation, General: Comply with insulation manufacturer's written instructions applicable to products and application indicated.
 1. Install insulation that is undamaged, dry, unsoiled, and has not been exposed at any time to ice and snow.
 2. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
 3. Apply single layer of insulation to produce thickness indicated.
 4. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.
- B. Protect below-grade insulation on vertical surfaces from damage during backfilling by applying protection board. Set in adhesive according to written instructions of insulation manufacturer.
- C. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors.
- D. Place loose-fill insulation into spaces and onto surfaces as shown, either by pouring or by machine blowing to comply with ASTM C 1015.
 1. For cellulosic loose-fill insulation, comply with the Cellulose Insulation Manufacturers Association's "Special Report--Standard Practice for Installing Cellulose Insulation."
- E. Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system.
- F. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes.

END OF SECTION 072100

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SECTION 072410 - EXTERIOR INSULATION AND FINISH SYSTEMS - CLASS PB

PART 1 - GENERAL

1..1 RELATED DOCUMENTS:

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

1..2 SUMMARY:

- A. Extent of exterior insulation and finish systems is indicated on drawings.
- B. Types of exterior insulation and finish system applications in this section include the following:
 - 1. Applications over gypsum sheathing and/or miscellaneous existing building surfaces including CMU.
- C. Gypsum sheathing behind system, if required for field application to wood framing, is specified in Division-6 Section "Rough Carpentry".
- D. Sealing joints is specified in this section.
- E. Sealing joints in system with elastomeric joint sealants is specified in Division-7 section "Joint Sealers".

1..3 DEFINITIONS:

- A. Exterior insulation and finish system refers to an exterior assembly composed of an inner layer of thermal insulation board and an outer layer forming the protective finish coating. The assembly is applied to a supporting substrate of construction indicated. Designations below for the class and type of exterior insulation and finish system specified in this section are based on those developed by the Exterior Insulation Manufacturers Association (EIMA).
 - 1. Class PB Type A designates a polymer-based protective finish coating (Class PB), externally reinforced (Type A).
- B. System in this section refers to Class PB Type A exterior insulation and finish systems.
- C. System manufacturer refers to the manufacturer of the exterior insulation and finish system.

1..4 SYSTEM DESCRIPTION:

- A. Provide system complying with the following performance requirements:
 - 1. Bond Integrity: Free from bond failure within system components for between system and supporting wall construction, resulting from exposure to fire, wind loads, weather, or other in-service conditions.
 - 2. Weathertightness: Resistant to water penetration from exterior into system and assemblies behind it or through them into interior of building which results in deterioration of thermal-insulating effectiveness or other degradation of system and assemblies behind system including substrates, supporting wall construction, and interior finish.

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3. Fire Performance Characteristics: Provide materials and construction which are identical to those tested for the following fire performance characteristics, per test method indicated below, by UL or other testing and inspecting agencies acceptable to authorities having jurisdiction:
 - a. Surface Burning Characteristics: Flame spread rating of 25 or less per ASTM E 84 for insulation board and protective finish coats, when each is tested individually.

1..5 SUBMITTALS:

- A. Product Data: Manufacturer's technical data for each component of exterior insulation and finish system.
- B. Samples for Verification Purposes: Samples, 2' square, for each finish, color, and texture indicated; prepare samples using same tools and techniques intended for actual work.
 1. Incorporate within each sample a typical control joint filled with sealant of color indicated or selected.
- C. Installer certificates signed by manufacturer certifying that Installers comply with specified requirements.
- D. Test reports for system from a qualified independent testing laboratory certifying and interpreting test results relative to system's compliance with requirements for fire performance characteristics, bond integrity, and material properties.
- E. Sealant compatibility and test report from sealant manufacturer certifying that materials forming joint substrates of system have been tested for compatibility and adhesion with joint sealants; include sealant manufacturer's interpretation of results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.
- F. Research reports or evaluation reports of the model code organization acceptable to authorities having jurisdiction which evidence system's compliance with building code in effect for project.

1..6 QUALITY ASSURANCE:

- A. Manufacturer Qualifications: Firm regularly engaged in manufacturing products for system indicated and with at least 5 years successful experience in applications similar to that required for this Project.
- B. Installer Qualifications: Engage an Installer that is certified in writing by system manufacturer as qualified for installation of systems indicated.
- C. Single Source Responsibility: Obtain materials for system from either a single manufacturer or from manufacturers approved by the system manufacturer as compatible with other system components.
- D. Field-Constructed Mock-Up: Prior to installation of system, erect mock-ups for each form of wall construction and finish required to verify selections made under sample submittals and to demonstrate aesthetic effects including those related to execution. Build mock-ups to comply with the following requirements, using materials indicated for final work:
 1. Locate mock-ups on site minimum of 24 x 24 inches
 2. Demonstrate the proposed range of color, texture, and workmanship to be expected in completed work.
 3. Obtain Architect's acceptance of mock-ups before start of final work.
 4. Retain and maintain mock-ups during construction for judging completed work.

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- a. When directed, demolish mock-ups and remove from Project site.
 - b. Accepted mock-ups in undisturbed condition at time of Substantial Completion may become part of completed work.
 - E. Pre-Installation Conference: Conduct conference at Project site for purposes of ensuring coordinated and timely execution of work of this section; comply with Division-1 requirements.
- 1..7 DELIVERY, STORAGE, AND HANDLING:
- A. Deliver products in original, unopened packages with manufacturer's labels identifying products legible and intact.
 - B. Store materials inside and under cover; keep them dry, protected from the weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, damage from construction traffic and other causes.
 - C. Stack insulation board flat and off the ground.
- 1..8 PROJECT CONDITIONS:
- A. Environmental Conditions: Do not install system when ambient outdoor temperatures are 40 deg F (4 deg C) and falling unless temporary protection and heat is provided to maintain ambient temperatures above 40 deg F (4 deg C) during installation of wet materials and for 24 hours after installation or longer to allow them to become thoroughly dry and weather resistant.
- 1..9 SEQUENCING AND SCHEDULING:
- A. Sequence installation of system with related work specified in other sections to ensure that wall assemblies, including flashing, trim, and joint sealers, are protected against damage from weather, aging, corrosion, or other causes.

PART 2 - PRODUCTS

- 2..1 MANUFACTURERS:
- A. Manufacturers: Subject to compliance with requirements, provide Class PB Type A system of one of the following:
 - 1. Senergy
- 2..2 MATERIALS:
- A. Compatibility: Provide adhesive, board insulation, reinforcing fabrics, base and finish coat materials, sealants, and accessories which are compatible with one another and approved for use by system manufacturer.
 - B. Provide colors and texture of protective coating to comply with following requirements:
 - 1. Match Architect's sample.
 - C. Surface-Sealer: System manufacturer's standard adhesion intermediary designed to improve bond

between substrate of type indicated and adhesive for application of insulation.

- D. Adhesive for Application of Insulation: System manufacturer's standard formulation designed for indicated use, compatible with substrate and complying with the following requirements:
 - 1. Job-mixed formulation of portland cement complying with ASTM C 150, Type 1, and polymer-based adhesive specified for base coat.
- E. Molded Polystyrene Board Insulation: Rigid, cellular thermal insulation formed by the expansion of polystyrene resin beads or granules in a closed mold to comply with ASTM C 578 for Type I; aged in block form prior to cutting and shipping by air drying for not less than 6 weeks or by another method approved by system manufacturer and producing equivalent results; 2' x 4' x thickness indicated but not less than the minimum thickness allowed by system manufacturer; and complying with requirements of system manufacturer for corner squareness and other dimensional tolerances.
- F. Reinforcing Fabric: Balanced, alkali-resistant open weave glass fiber fabric treated for compatibility with other system materials; made from continuous multi-end strands with tensile strength of not less than 120 lbs. and 140 lbs. in warp and fill directions, respectively, per ASTM D 1682 and complying with ASTM D 578 and the following requirements:
 - 1. Weight of Standard Reinforcing Fabric: Not less than 3.75 oz. per sq. yd.
- G. Base Coat Materials: System manufacturer's standard, job-mixed formulation of portland cement complying with ASTM C 150, Type I, white or natural color; and system manufacturer's standard polymer-based adhesive designed for use indicated.
- H. Finish Coat Materials: System manufacturer's standard mixture complying with the following requirements for material composition and method of combining materials:
 - 1. Factory-mixed formulation of polymer emulsion admixture, color- fast mineral pigments, sound stone particles, and fillers.
 - 2. Job-mixed formulation of system manufacturer's standard polymer emulsion adhesive and marble chips of particle size indicated below, for embedding in adhesive to produce an exposed aggregate finish.
 - a. Particle Size: 0.05".
- I. Water: Clean and potable.
- J. Mechanical Fasteners: System manufacturer's standard corrosion- resistant fastener assemblies, complete with system manufacturer's standard washer and shaft attachments, selected for properties of pull-out, tensile, and shear strength required to resist design loads of application indicated, capable of pulling fastener head below surface of insulation board, and of the following description:
 - 1. For attachment to wood framing members provide steel drill screws complying with ASTM C 1002.

2..3 ELASTOMERIC SEALANTS:

- A. Sealant Products: Provide manufacturer's standard chemically curing, elastomeric sealant which is compatible with joint fillers, joint substrates, and other related materials and complies with requirements of Division-7 section "Joint Sealers" for products corresponding to description indicated below.
 - 1. Multi-Part Nonsag Urethane Sealant.

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B. Sealant Color: Provide color of exposed sealants to comply with the following requirement:

1. Match color of Architect's sample.

2..4 MIXING:

A. General: Comply with system manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials except as approved by system manufacturer. Mix materials in clean containers. Use materials within time period specified by system manufacturer or discard.

PART 3 - EXECUTION

3..1 EXAMINATION:

A. Examine substrates, with Installer present, to determine if they are in satisfactory condition for installation of system. Do not proceed with installation of system until unsatisfactory conditions have been corrected.

3..2 PREPARATION:

- A. Protect contiguous work from moisture deterioration and soiling resulting from application of systems. Provide temporary covering and other protection needed to prevent spattering of exterior finish coatings on other work.
- B. Protect system, substrates, and wall construction behind them from inclement weather during installation. Prevent infiltration of moisture behind system and deterioration of substrates.
- C. Substrate Preparation: Prepare and clean substrates to comply with system manufacturer's requirements to obtain optimum bond between substrate and adhesive for insulation.
1. Apply surface-sealer over substrates where required by system manufacturer for improving adhesion.

3..3 INSTALLATION:

- A. General: Comply with system manufacturer's current published instructions for installation of system as applicable to each type of substrate indicated.
- B. Adhesively attach insulation to comply with the following requirements:
- C. Adhesively and mechanically attach insulation to comply with the following requirements:
1. Allow adhered insulation to remain undisturbed for period prescribed by system manufacturer but not less than 24 hours, prior to beginning rasping and sanding insulation or application of base coat and reinforcing fabric.
- D. Apply base coat to exposed surfaces of insulation in minimum thickness specified by system manufacturer.
- E. Fully embed reinforcing fabric of weight indicated below in wet base coat to produce wrinkle-free

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installation with fabric continuous at corners and lapped or otherwise treated at joints to comply with system manufacturer's requirements.

1. Fabric Weight: Standard, unless otherwise indicated.

F. Apply finish coat over dry base coat in thickness required by system manufacturer to produce a uniform finish of texture and color matching approved sample.

3..4 INSTALLATION OF JOINT SEALANTS:

A. Prepare joints and apply sealants, of type and at locations indicated, to comply with applicable requirements of Division-7 section "Joint Sealers". Install at edges of stucco system where adjoining to all other materials including base of system where the system contacts stone or concrete.

3..5 CLEANING AND PROTECTION:

A. Remove temporary covering and protection of other work. Promptly remove protective coatings from window and door frames, and any other surfaces outside areas indicated to receive protective coating.

B. Provide final protection and maintain conditions, in a manner acceptable to Installer and system manufacturer, which ensures system being without damage or deterioration at time of Substantial Completion.

END OF SECTION - 072410

PART 1 - GENERAL

- 1.01 GENERAL REQUIREMENTS
- A. This Specification shall be read as a whole by all parties concerned. Each Section may contain more or less the complete Work of any trade. The Contractor is solely responsible to make clear to the Subcontractors the extent of their Work and coordinate overlapping Work.
- 1.02 SYSTEM DESCRIPTION
- A. Supply labor, materials and equipment for a mechanically attached water-resistive vapor permeable air barrier membrane system, suitable for open joint cladding where designs allow for permanent UV exposure.
- B. Complete Work as shown on the Drawings and specified herein to bridge gaps and seal the water-resistive vapor permeable air barrier membrane against air leakage and water intrusion.
1. Connections of the walls to the roof membrane
 2. Connections of the walls to the foundations
 3. Seismic and expansion joints
 4. Openings and penetrations of window and door frames, store front, curtain wall
 5. Piping, conduit, duct and similar penetrations
 6. Masonry ties, screws, bolts and similar penetrations
 7. All other air leakage pathways in the building envelope
- C. Install primary water-resistive vapor permeable air barrier, flashings, lap integrated seam tapes, sealants, and all related accessories as required by the manufacturer to achieve a continuous air barrier assembly.
- 1.03 RELATED SECTIONS
- A. Wall Panels:
- 1.04 REFERENCE STANDARDS
- A. American Association of Textile Chemists and Colorists (AATCC): ATCC 127 - Test Method for Water Resistance: Hydrostatic Pressure Test.
- B. ASTM International (ASTM):
1. ASTM D 828 - Test Method for Tensile Properties of Thin Plastic Sheeting
 2. ASTM E 84 - Test Method for Surface Burning Characteristics of Building Materials
 3. ASTM E 96/E 96M - Test Methods for Water Vapor Transmission of Materials
 4. ASTM E 283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
 5. ASTM E 2178 - Standard Test Method for Air Permeance of Building Materials
- C. International Code Council Evaluation Service, Inc. (ICC-ES): ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers.
- 1.05 SUBMITTALS
- A. Submit documentation from an approved independent testing laboratory certifying compliance with, a) the resistance to Hydrostatic Pressure, b) ASTM D 828 - Tensile Properties, c) ASTM E 84 - Class A Surface Burning Characteristics, d) ASTM E 96/E 96M - Test Methods for Water Vapor Transmission of Materials, and e) ASTM E 2178 - Standard Test Method For Air Permeance of Building Materials.
- B. Submit documentation from an approved independent testing laboratory certifying the membrane meets ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers.
- C. Submit manufacturers' current product data sheets, details and installation instructions for the mechanically attached water-resistive vapor permeable air barrier membrane components and accessories.
- D. Submit samples of the following:
1. Manufacturer's sample warranty
 2. Water-resistive vapor permeable air barrier sheet, minimum 8 by 10 inches (203 by 254 mm)
 3. Components, minimum 12-inch (305-mm) lengths
 4. Membrane flashings and lap seam tapes
 5. Fasteners, clips, strapping and masonry ties
 6. Sealants
- 1.06 QUALITY ASSURANCE
- A. Single Source: Water-resistive vapor permeable air barrier membrane components and accessories must be obtained as a single-source membrane system to ensure total system compatibility and integrity.
- B. Manufacturer Qualifications

1. Manufacturer of specified products listed in this Section to have minimum 8 years of continued experience in the manufacture and supply of highly vapor permeable water resistive air barrier products successfully installed in similar project applications.
 2. Manufacturer of specified products listed in this Section to have experienced in-house technical and field observation personal qualified to provide expert technical support.
- C. Fire Performance Characteristics: Provide water-resistive, vapor permeable air barrier meeting the following fire-test characteristics.
1. Surface-Burning Characteristics: ASTM E 84
 2. Flame spread index: 25 or less
 3. Smoke developed index: 450 or less

1.07 MOCK-UP

- A. Construct mock-up in accordance with Section 01 43 39 – Mock-ups.
- B. Provide mock-up of specified water-resistive vapor permeable air barrier materials under provisions of Section 01 33 23 Shop Drawings, Product Data and Samples.
- C. Where directed by [engineer] [architect] [consultant], construct typical exterior wall panel, 6 foot long by 6 foot wide incorporating the sheathing board or substrate, sill pan protection system, window frame and attachment method, clips, strapping or masonry ties, attachment of insulation and detailing of water-resistive, vapor permeable air barrier membrane application and lap seams.
 1. Perform water spray test of mockup to demonstrate performance.
- D. Allow 48 hours for inspection of mock-up by [engineer] [architect] [consultant] before proceeding with water-resistive, vapor permeable air barrier work. Mock-up may remain as part of the Work.

1.08 PRE-INSTALLATION CONFERENCE

- A. Contractor shall convene [one] week prior to commencing Work of this section, under provisions of Section 01 31 19 – Project Meetings.
- B. Ensure all contractors responsible for creating a continuous plane of water and air tightness are present.

1.09 DELIVERY, STORAGE AND HANDLING

- A. Refer to current Product MSDS and/or Product Data Sheets for proper storage and handling.
- B. Deliver materials to the job site in undamaged and original packaging indicating the name of the manufacturer and product.
- C. Store roll materials flat or on end in original packaging. Protect rolls from direct sunlight and inclement weather until ready for use.
- D. Waste Management and Disposal
 1. Separate and recycle waste materials in accordance with Section [01355 - Waste Management and Disposal], and with the Waste Reduction Work Plan.

1.10 COORDINATION

- A. Deliver materials to the job site in undamaged and original packaging indicating the name of the Ensure continuity of the water-resistive vapor permeable air barrier system throughout the scope of this section.

1.11 ALTERNATES

- A. Submit request for alternates in accordance with Section 01 25 00 – Substitution Procedures.
- B. Submit requests for alternates a minimum of ten (10) working days prior to bid date.
- C. Alternate submission to include:
 1. Evidence that alternate materials meet or exceed performance characteristics of specified Product requirements as well as documentation from an approved independent testing laboratory certifying the minimum physical dimensions, tensile strength, fire burning characteristics, vapor permeance and air leakage rates of the water-resistive vapor permeable air barrier membrane.
 2. Manufacturer’s complete set of details for water-resistive vapor permeable air barrier membrane system showing a continuous plane of water and air tightness throughout the building enclosure.
 3. Manufacturer of alternate materials has experienced in-house technical and field observation personal qualified to provide expert technical support
- D. Acceptable alternates will be confirmed by addendum. Substitute materials not approved in writing prior to bid date shall not be permitted for use on this project.

1.12 WARRANTY

- A. Provide manufacturer's standard material warranty in which manufacturer agrees to provide replacement material for water-resistive vapor permeable air barrier sheets installed in accordance with manufacturer's instructions that fails due to material defects within 20 years of the date of Purchase.

PART 2 - PRODUCTS

1.01 MATERIALS

- A. Primary water-resistive, vapor permeable, air barrier membrane components and accessories must be obtained at a single-source to ensure total system compatibility and integrity.
1. Water-resistive vapor permeable air barrier membrane by VaproShield LLC., Gig Harbor, WA, Ph (866) 731-7663, Email: info@VaproShield.com, Website: www.vaproshield.com.
- B. WATER-RESISTIVE VAPOR PERMEABLE AIR BARRIER MATERIALS (Basis of Design)
1. Primary water-resistive air barrier sheet membrane shall be RevealShield® Water-Resistive Vapor Permeable Air Barrier Sheet by VaproShield, a zero VOC mechanically attached water-resistive, vapor permeable air barrier sheet membrane consisting of multiple layers of UV stabilized material with integrated tape at horizontal seams, having the following properties:
 - a. Color: Black with allowable UV exposure for 180 days total before being covered by cladding
 - b. Air Leakage: < 0.00004 cfm/sq.ft. (0.0002 L/s/sq.m) when tested in accordance with ASTM E 2178 and < 0.000034 cfm/sq.ft. (0.00017 L/s/sq.m) when tested in accordance with ASTM E 283
 - c. Water Vapor Permeance tested to ASTM E 96 Method B: 42 perms (262.6 g/m²)
 - d. Water Resistance tested to AATCC 127, 550 mm hydrostatic head for 5 hours: No leakage
 - e. Tensile Strength tested to ASTM D 828: 44.8 lbf/inch (68 N/mm), machine direction; 21.3 lbf/inch (37.3 N/mm), cross-machine direction
 - f. Application Temperature: No temperature restrictions
 - g. Surface Burning Characteristics tested to ASTM E 84: Class A, Flame-spread index of less than 10, Smoke-development index of less than 135
 - h. Physical Dimensions: 0.020 inches (0.51 mm) thick and 59 inches (1.5 m) wide and 5 oz per sq. yd. (170 g/sq. m).
- C. WATER-RESISTIVE AIR BARRIER SHEET MEMBRANE FASTENERS
1. Water-resistive air barrier sheet membrane fasteners shall be corrosion-resistant or stainless steel screws of #6, 7, or 8, bugle-head design.
 2. Screw head caps for water-resistive air barrier sheet membrane shall be VaproCaps by VaproShield, a 1¾ inch diameter preformed head caps with a center throat hole that seals the membrane at the fastener penetration, specifically designed and tested to withstand wind loads and protect against water intrusion at screw penetrations.
 3. Selection of fastener thread type is subject to sheathing board and substrate type. Manufacturer recommends subcontractor to supply and place corrosion-resistant or stainless steel screws sized to penetrate gypsum sheathing board through to solid backing or steel studs or wood sheathing by ¾ inch in conjunction with preformed screw head caps.
- D. WATER-RESISTIVE AIR BARRIER JOINT SEALANT
1. Water-resistive air barrier sealant compatible with sheet membrane shall be Dow Corning® 758, a modified silicon-based Sealant tested for compatibility with VaproShield products.
- E. WATER-RESISTIVE AIR BARRIER TRANSITION AND FLASHING MEMBRANES
1. Mechanically attached air barrier transition and flashing membrane shall be RevealFlashing™ by VaproShield, a Black, highly UV stable, zero VOC mechanically attached water-resistive vapor permeable membrane having the following properties:
 - a. RevealFlashing™: 6 1/2 inches, 11 3/4 inches or 19 2/3 inches wide x 164 feet long
 - b. Air Leakage: < 0.0000263 cfm/sq. ft. @ 75 Pa (0.000134 L/s/m sq @ 75 Pa) when tested in accordance with ASTM E 2178
 - c. Water Vapor Permeance tested to ASTM E 96 Method B: 42 perms (2875ng/Pa.s.m²)
 - d. Water Resistance tested to AATCC 127, 550 mm hydrostatic head for 5 hours: No leakage
- F. WATER-RESISTIVE FLASHING AND PENETRATION TAPES
1. Tapes shall be VaproTape™ by VaproShield: UV stable, single sided, moisture-resistant flexible tape with adhesive backing having the following properties:

- a. VaproTape UV-Resistant Black: 35 mil thick by 4 inches (102 mm) wide penetration seam tape
 - b. VaproAlumaTape: 20 mil thick by 4.5 inches (114 mm) and 9 inches (229 mm) wide, foil faced, UV stable, moisture-resistant flashing and membrane transition tape for use with silicone sealants
- G. VAPROLIQUI-FLASH™ VAPOR PERMEABLE WATER RESISTIVE FLASHING FOR ROUGH OPENINGS
- 1. Window and door flashing shall be VaproLiqui-Flash by VaproShield, a liquid-applied vapor permeable air barrier flashing material with vapor permeance and resistance to air leakage properties compatible with the primary air barrier membrane.
- H. SILL PAN PROTECTION SYSTEM
- 1. Sill Pan Protection System: Extruded PVC sections with integral sloped shape, preformed corner dams and window unit spacer supports configured to drain moisture from window unit base to exterior shall be VaproSillSaver™ by VaproShield. Coordinate selection of sill pan depth with window unit frame size. VaproSillSaver is designed for use with nail flanged equipped windows only.
- I. WATER-RESISTIVE WEATHER BARRIER BATTEN and VENTILATION ACCESSORIES
- 1. Water-resistive weather barrier batten and ventilation accessories by VaproShield shall be made of black PVC material
 - a. VaproBatten™: Black vinyl extrusion with pre-formed fastener and moisture drainage channels configured to create a ventilated airspace between wall cladding and weather-resistive barrier. VaproVent™ L Strip and VaproVent™ Hook Strip not necessary in typical open joint cladding systems.
- 2.02 PENETRATION SEALANT
- A. Provide sealant for penetrations as recommended by manufacturer and as specified under Division 07 Section: Sealants. Appropriate sealants shall be Dow 758 or VaproLiqui-Flash.

PART 3 EXECUTION

3.01 GENERAL

- A. Verify that surfaces and conditions are ready to accept the Work of this section. Notify architect in writing of any discrepancies. Commencement of the Work or any parts thereof shall mean acceptance of the prepared substrates.
- B. All surfaces must be sound, clean and free of oil, grease, dirt, excess mortar or other contaminants detrimental to the adhesion of the water resistive air barrier flashings. Fill voids, gaps in substrate to provide an even surface. Strike masonry joints full-flush.
- C. Minimum application temperature self-adhered membrane flashings to be above 20 degrees F (minus 6.0 degrees C).
- D. Ensure all preparatory Work is complete prior to applying primary water-resistive weather barrier membrane.
- E. Mechanical fasteners used to secure sheathing boards or penetrate sheathing boards shall be set flush with sheathing and fastened into solid backing.

3.12 PROTECTION

- A. Protect wall areas covered with primary water-resistive vapor permeable air barrier from damage due to construction activities, high wind conditions, and extended exposure to inclement weather.
- B. Review condition of water-resistive weather barrier prior to installation of cladding. Repair, or remove and replace damaged sections with new membrane.
- C. Recommend to cap and protect exposed back-up walls against wet weather conditions during and after application of membrane, including wall openings and construction activity above completed primary water-resistive weather barrier installations.
- D. Remove and replace water-resistive vapor permeable air barrier affected by chemical spills or surfactants.

END OF SECTION

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SECTION 076000 - FLASHING AND SHEET METAL

PART 1 - GENERAL

1..1 RELATED DOCUMENTS

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

1..2 SUMMARY

- A. This Section includes the following:
 - 1. Metal counter flashing; and base flashing.
 - 2. Internal Gutters and downspouts (rain drainage).
 - 3. Miscellaneous sheet metal accessories.
- B. Roofing accessories which are installed integral with roofing membrane are specified in roofing system sections as roofing work.

1..3 SUBMITTALS

- A. Product data; Flashing, Sheet Metal, and Accessories: Manufacturer's technical product data, installation instructions and general recommendations for each specified sheet material and fabricated product.
- B. Samples of the following flashing, sheet metal, and accessory items:
 - 1. 8 inch square samples of specified sheet materials to be exposed as finished surfaces.
 - 2. 12 inch long samples of factory-fabricated products exposed as finished work. Provide complete with specified factory finish.

1..4 PROJECT CONDITIONS

- A. Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of work and protection of materials and finishes.

PART 2 - PRODUCTS

2..1 SHEET METAL FLASHING AND TRIM MATERIALS

- A. Zinc-Coated Steel: Commercial quality with 0.20 percent copper, ASTM A 526 except ASTM A 527 for lock-forming, G90 hot-dip galvanized, mill phosphatized where indicated for painting; 0.0359 inch thick (20 gage) except as otherwise indicated.
- B. Aluminum: ASTM B 209, alloy 3003, temper H14, AA-C22A41 clear anodized finish; 0.032 inch thick (20 gage) except as otherwise indicated.

2..2 LAMINATED COMPOSITION SHEET FLASHING

- A. Miscellaneous Materials and Accessories:
1. Fasteners: Same metal as flashing/sheet metal or, other non-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.
 2. Bituminous Coating: SSPC - Paint 12, solvent type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry film thickness per coat.
 3. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, non-drying, nonmigrating sealant.
 4. Elastomeric Sealant: Generic type recommended by manufacturer of metal and fabricator of components being sealed and complying with requirements for joint sealants as specified in Division 7 Section "Joint Sealers."
 5. Epoxy Seam Sealer: 2-part noncorrosive metal seam cementing compound, recommended by metal manufacturer for exterior/interior non-moving joints including riveted joints.
 6. Adhesives: Type recommended by flashing sheet manufacturer for waterproof/weather-resistant seaming and adhesive application of flashing sheet.
 7. Paper Slip Sheet: 5-lb. rosin-sized building paper.
 8. Polyethylene Underlayment: Minimum 6-mil carbonated polyethylene film; resistant to decay when tested in accordance with ASTM E 154.
 9. Reglets: Metal or plastic units of type and profile indicated, compatible with flashing indicated, noncorrosive.
 10. Metal Accessories: Provide sheet metal clips, straps, anchoring devices and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gage required for performance.
 11. Gutter and Conductor-Head Guards: 20-gage bronze or nonmagnetic stainless steel mesh or fabricated units, with salvaged edges and noncorrosive fasteners. Select materials for compatibility with internal gutters and interior downspouts.
 12. Roofing Cement: ASTM D 2822, asphaltic.

2..3 FABRICATED UNITS

- A. General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with details shown, and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate for waterproof and weather-resistant performance; with expansion provisions for running work, sufficient to permanently prevent leakage, damage or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal work without excessive oil-canning, buckling and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.
- B. Seams: Fabricate non-moving seams in sheet metal with flat-lock seams. For metal other than aluminum, tin edges to be seamed, form seams, and solder. Form aluminum seams with epoxy seam sealer; rivet joints for additional strength where required.
- C. Expansion Provisions: Where lapped or bayonet-type expansion provisions in work cannot be used, or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- D. Sealant Joints: Where movable, non-expansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.
- E. Separations: Provide for separation of metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.

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- F. Shop Finish, Rain Drainage: Provide Kynar 500 to match roofing finish on sheet metal rain drainage units (gutters, downspouts, and similar exposed units); 1.0 mil dry film thickness.

PART 3 - EXECUTION

3..1 INSTALLATION REQUIREMENTS

- A. General: Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations, and with SMACNA "Architectural Sheet Metal Manual". Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints and seams which will be permanently watertight and weatherproof.
- B. Underlayment: Where stainless steel or aluminum is to be installed directly on cementitious or wood substrates, install a slip sheet of red rosin paper and a course of polyethylene underlayment.
- C. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.
- D. Install reglets to receive counterflashing in manner and by methods indicated.
 - 1. Install counterflashing in reglets, either by snap-in seal arrangement, or by welding in place for anchorage and filling reglet with mastic or elastomeric sealant, as indicated and depending on degree of sealant exposure.
- E. Nail flanges of expansion joint units to curb nailers, at maximum spacing of 6 inches o.c. Fabricate seams at joints between units with minimum 3 inch overlap, to form a continuous, waterproof system.
- F. Install continuous gutter guards on gutters, arranged as hinged units to swing open for cleaning gutters. Install "beehive" type strainer-guard, removable for cleaning internal wall downspouts. See detail.

3..2 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces, removing substances which might cause corrosion of metal or deterioration of finishes.
- B. Protection: Advise Contractor of required procedures for surveillance and protection of flashings and sheet metal work during construction, to ensure that work will be without damage or deterioration, other than natural weathering at time of substantial completion.

END OF SECTION 076000

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SECTION 079000 - JOINT SEALERS

PART 1 - GENERAL

1..1 RELATED DOCUMENTS:

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

1..2 SUMMARY:

- A. Extent of each form and type of joint sealer is indicated on drawings and schedules.
- B. This Section includes joint sealers for the following locations:
 - 1. Exterior joints in vertical surfaces and nontraffic horizontal surfaces as indicated below.
 - a. Control and expansion joints in cast-in-place concrete.
 - b. Joints of masonry set with mortar.
 - c. Joints between different materials listed above.
 - d. Perimeter joints between materials listed above and frames of doors and windows.
 - e. Control and expansion joints in ceiling and overhead surfaces.
 - f. Other joints as indicated.
 - 2. Exterior joints in horizontal traffic surfaces as indicated below:
 - a. Control, expansion, and isolation joints in cast-in-place concrete slabs for floors and paving.
 - 3. Interior joints in vertical surfaces and horizontal nontraffic surfaces as indicated below:
 - a. Perimeter joints of exterior openings where indicated.
 - b. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
 - c. Perimeter joints of toilet fixtures.
 - d. Other joints as indicated.
 - 4. Interior joints in horizontal traffic surfaces as indicated below:
 - a. Control and expansion joints in cast-in-place concrete slabs.
 - b. Other joints as indicated.
- C. Sealing joints in exterior masonry is specified in Division-4 Section "Masonry".
- D. Sealing joints in exterior insulation and finish system is specified in the following Division-7 section:
 - 1. "Exterior Insulation and Finish Systems - Class PB."
- E. Sealing joints related to flashing and sheet metal for roofing is specified in Division-7 Section: "Flashing and Sheet Metal."
- F. Sealants for glazing purposes are specified in Division-8 Section "Glass and Glazing."
- G. Sealing tile joints is specified in Division-9 Section "Tile."

1..3 SYSTEM PERFORMANCES:

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- A. Provide joint sealers that have been produced and installed to establish and maintain watertight and airtight continuous seals.

1..4 SUBMITTALS:

- A. Product Data from manufacturers for each joint sealer product required, including instructions for joint preparation and joint sealer application.
- B. Samples for Initial Selection Purposes: Manufacturer's standard bead samples consisting of strips of actual products showing full range of colors available, for each product exposed to view.
- C. Samples for verification purposes of each type and color of joint sealer required. Install joint sealer samples in 1/2 inch wide joints formed between two 6 inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealers.
- D. Certificates from manufacturers of joint sealers attesting that their products comply with specification requirements and are suitable for the use indicated.
- E. Qualification data complying with requirements specified in "Quality Assurance" article. Include list of completed projects with project name, addresses, names of Architects and Owners, plus other information specified.
- F. Compatibility and adhesion test reports from elastomeric sealant manufacturer indicating that materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.
- G. Product test reports for each type of joint sealers indicated, evidencing compliance with requirements specified.
- H. Preconstruction field test reports indicating which products and joint preparation methods demonstrated acceptable adhesion to joint substrates.

1..5 QUALITY ASSURANCE:

- A. Installer Qualifications: Engage an Installer who has successfully completed within the last 3 years at least 3 joint sealer applications similar in type and size to that of this Project.
- B. Single Source Responsibility for Joint Sealer Materials: Obtain joint sealer materials from a single manufacturer for each different product required.
 - 1. Submit not less than 9 pieces of each type of material, including joint substrates, shims, joint sealant backings, secondary seals, and miscellaneous materials.

1..6 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver materials to Project site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturers' recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

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1..7 PROJECT CONDITIONS:

- A. Environmental Conditions: Do not proceed with installation of joint sealers under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealer manufacturers.
 - 2. When ambient and substrate temperature conditions are outside the limits permitted by joint sealer manufacturer or below 40 deg F (4.4 deg C).
 - 3. When joint substrates are wet due to rain, frost, condensation, or other causes.
- B. Joint Width Conditions: Do not proceed with installation of joint sealers where joint widths are less than allowed by joint sealer manufacturer for application indicated.
- C. Joint Substrate Conditions: Do not proceed with installation of joint sealers until contaminants capable of interfering with their adhesion are removed from joint substrates.

1..8 SEQUENCING AND SCHEDULING:

- A. Sequence installation of joint sealers to occur not less than 21 nor more than 30 days after completion of waterproofing, unless otherwise indicated.

PART 2 - PRODUCTS

2..1 MATERIALS, GENERAL:

- A. Compatibility: Provide joint sealers, joint fillers and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Colors: Provide color of exposed joint sealers indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors.

2..2 ELASTOMERIC JOINT SEALANTS:

- A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated which complies with ASTM C 920 requirements, including those referenced for Type, Grade, Class, and Uses.
- B. One-Part High-Modulus Nonacid-Curing Silicone Sealant: Type S; Grade NS; Class 25; Uses NT, M, G, A, and, as applicable to joint substrates indicated, O.
- C. One-Part Acid-Curing Silicone Sealant: Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to joint substrates indicated, O.
- D. One-Part Pourable Urethane Sealant for Use T: Type S, Grade P, Class 25, and complying with the following requirements for Uses:
 - 1. Uses T, M, G, A, and, as applicable to joint substrates indicated, O.
 - 2. Uses T, M, A, and, as applicable to joint substrates indicated, O.
 - 3. Uses T, M and, as applicable to joint substrates indicated, O.

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E. Products: Subject to compliance with requirements, provide one of the following:

1. One-Part Nonacid-Curing High-Modulus Silicone Sealant:

- a. "Dow Corning 784"; Dow Corning Corp.
- b. "Dow Corning 799"; Dow Corning Corp.
- c. "Ultraglaze SSG 4000"; General Electric Co.

2. One-Part Acid-Curing Silicone Sealant:

- a. "Dow Corning 999A"; Dow Corning Corp.

2..3 JOINT SEALANTS FOR PAVING:

A. Products: Available Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:

1. Hot-Poured Elastomeric Sealant for Concrete and Asphalt Pavements:

- a. "Hotpour Spec"; J. & P. Petroleum Products, Inc.

2..4 JOINT SEALANT BACKING:

A. General: Provide sealant backings of material and type which are nonstaining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonwaxing, nonextruding strips of flexible, nongassing plastic foam of material indicated below; nonabsorbent to water and gas; and of size, shape and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

1. Open-cell polyurethane foam for cold-applied sealants only.
2. Closed-cell polyethylene foam.
3. Either open-cell polyurethane foam or closed-cell polyethylene foam, unless otherwise indicated, subject to approval of sealant manufacturer, for cold-applied sealants only.

C. Elastomeric Tubing Joint Fillers: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, capable of remaining resilient at temperatures down to -26 deg F (-15 deg C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2..5 MISCELLANEOUS MATERIALS:

A. Primer: Provide type recommended by joint sealer manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealer-substrate tests and field tests.

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- B. Cleaners for Nonporous Surfaces: Provide nonstaining, chemical cleaners of type which are acceptable to manufacturers of sealants and sealant backing materials, which are not harmful to substrates and adjacent nonporous materials, and which do not leave oily residues or otherwise have a detrimental effect on sealant adhesion or in-service performance.
- C. Masking Tape: Provide nonstaining, nonabsorbent type compatible with joint sealants and to surfaces adjacent to joints.

2.6 JOINT FILLERS FOR CONCRETE PAVING:

- A. General: Provide joint fillers of thickness and widths indicated.
- B. Self-Expanding Cork Joint Filler: Preformed strips complying with ASTM D 1752 for Type III.
- C. Cork Joint Filler: Preformed strips complying with ASTM D 1752 for Type II.
- D. Sponge Rubber Joint Filler: Preformed strips complying with ASTM D 1752 for Type I.
- E. Bituminous Fiber Joint Filler: Preformed strips of composition below, complying with ASTM D 1751:
 - 1. Asphalt saturated fiberboard.
 - 2. Granulated cork with asphalt binder encased between 2 layers of saturated felt or glass-fiber felt of width and thickness indicated.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Examine joints indicated to receive joint sealers, with Installer present, for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealer performance. Do not proceed with installation of joint sealers until unsatisfactory conditions have been corrected.

3.2 PREPARATION:

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealers to comply with recommendations of joint sealer manufacturers and the following requirements:
 - 1. Remove all foreign material from joint substrates which could interfere with adhesion of joint sealer, including dust; paints, except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer; old joint sealers; oil; grease; waterproofing; water repellants; water; surface dirt; and frost.
 - 2. Clean concrete, masonry, unglazed surfaces of ceramic tile and similar porous joint substrate surfaces, by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealers. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
 - 3. Remove laitance and form release agents from concrete.
 - 4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile; and other nonporous surfaces by chemical cleaners or other means which are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealers.
- B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealer manufacturer based on preconstruction joint sealer-substrate tests or prior experience. Apply primer

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to comply with joint sealer manufacturer's recommendations. Confine primers to areas of joint sealer bond, do not allow spillage or migration onto adjoining surfaces.

- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces which 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 SEALERS:

- A. General: Comply with joint sealer manufacturers' printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
- B. Elastomeric Sealant Installation Standard: Comply with recommendations of ASTM C 962 for use of joint sealants as applicable to materials, applications and conditions indicated.
- C. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
 - 1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths which allow optimum sealant movement capability.
 - a. Do not leave gaps between ends of joint fillers.
 - b. Do not stretch, twist, puncture, or tear joint fillers.
 - c. Remove absorbent joint fillers which have become wet prior to sealant application and replace with dry material.
 - 2. Install bond breaker tape between sealants and joint fillers, compression seals, or back of joints where adhesion of sealant to surfaces at back of joints would result in sealant failure.
- D. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths which allow optimum sealant movement capability.
- E. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
 - 1. Provide concave joint configuration per Figure 6A in ASTM C 962, unless otherwise indicated.
 - 2. Provide Recessed joint configuration per Figure 6C in ASTM C 962, of recess depth and at locations indicated.
- F. Installation of Preformed Hollow Neoprene Gaskets: Install gaskets, with minimum number of end joints, in joint recesses with edges free of spalls and sides straight and parallel, both within tolerances specified by gasket manufacturer. Apply manufacturer's recommended adhesive to joint substrates immediately prior to installing gaskets. For straight sections provide gaskets in continuous lengths; where changes in direction occur, adhesively splice gasket together to provide watertight joint. Recess gasket below adjoining joint surfaces by 1/8 inch to 1/4 inch.

3..4 CLEANING:

- A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealers and of products in which joints

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occur.

3..5 PROTECTION:

- A. Protect joint sealers during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealers immediately and reseal joints with new materials to produce joint sealer installations with repaired areas indistinguishable from original work.

END OF SECTION 079000

SECTION 081100 - STEEL 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes steel doors and frames.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 4 Section "Unit Masonry" for building anchors into and grouting frames in masonry construction.
 - 2. Division 8 Section "Flush Wood Doors" for hollow-core and solid-core wood doors installed in steel frames.
 - 3. Division 8 Section "Door Hardware" for door hardware and weatherstripping.
 - 4. Division 8 Section "Glazing" for glass in steel doors and sidelights.
 - 5. Division 9 Section "Gypsum Board Assemblies" for spot grouting frames in gypsum board partitions.
 - 6. Division 9 Section "Painting" for field painting primed doors and frames.

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for each type of door and frame specified, including details of construction, materials, dimensions, hardware preparation, core, label compliance, sound ratings, profiles, and finishes.
- C. Shop Drawings showing fabrication and installation of steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.
- D. Door Schedule: Submit schedule of doors and frames using same reference numbers for details and openings as those on Contract Drawings.
 - 1. Indicate coordination of glazing frames and stops with glass and glazing requirements.

1.4 QUALITY ASSURANCE

- A. Provide doors and frames complying with ANSI/SDI 100 "Recommended Specifications for Standard Steel Doors and Frames" and as specified.

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- B. Fire-Rated Door Assemblies: Units that comply with NFPA 80, are identical to door and frame assemblies tested for fire-test-response characteristics per ASTM E 152, and are labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.
- B. Inspect doors and frames on delivery for damage. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect; otherwise, remove and replace damaged items as directed.
- C. Store doors and frames at building site under cover. Place units on minimum **4-inch- (100-mm-)** high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If cardboard wrappers on doors become wet, remove cartons immediately. Provide minimum **1/4-inch (6-mm)** spaces between stacked doors to promote air circulation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Steel Doors and Frames:
 - a. Amweld Building Products, Inc.
 - b. Benchmark Commercial Doors.
 - c. Ceco Door Products.
 - d. Copco Door Co.
 - e. Curries Co.
 - f. Deansteel Manufacturing Co.
 - g. Fenestra Corp.
 - h. Kewanee Corp.
 - i. Mesker Door, Inc.
 - j. Pioneer Industries.
 - k. Republic Builders Products.
 - l. Steelcraft.

2.2 MATERIALS

- A. Hot-Rolled Steel Sheets and Strip: Commercial-quality carbon steel, pickled and oiled, complying with **ASTM A 569 (ASTM A 569M)**.
- B. Cold-Rolled Steel Sheets: Carbon steel complying with **ASTM A 366 (ASTM A 366M)**, commercial quality, or **ASTM A 620 (ASTM A 620M)**, drawing quality, special killed.

- C. Galvanized Steel Sheets: Zinc-coated carbon steel complying with ASTM A 526 (ASTM A 526M), commercial quality, or ASTM A 642 (ASTM A 642M), drawing quality, hot-dip galvanized according to ASTM A 525, with A 60 or G 60 (ASTM A 525M, with Z 180 or ZF 180) coating designation, mill phosphatized.
- D. Supports and Anchors: Fabricated from not less than 0.0478-inch- (1.2-mm-) thick steel sheet; 0.0516-inch- (1.3-mm-) thick galvanized steel where used with galvanized steel frames.
- E. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where items are to be built into exterior walls, hot-dip galvanize complying with ASTM A 153, Class C or D as applicable.

2.3 DOORS

- A. Steel Doors: Provide 1-3/4-inch- (44-mm-) thick doors of materials and ANSI/SDI 100 grades and models specified below, or as indicated on Drawings or schedules:
 - 1. Interior Doors: Grade I, standard-duty, Model 1, full flush design, minimum 0.0359-inch- (0.9-mm-) thick cold-rolled steel sheet faces.
 - 2. Exterior Doors: Grade III, extra heavy-duty, Model 1, full flush design, minimum 0.0635-inch- (1.6-mm-) thick galvanized steel sheet faces.

2.4 FRAMES

- A. Provide metal frames for doors, transoms, sidelights, borrowed lights, and other openings, according to ANSI/SDI 100, and of types and styles as shown on Drawings and schedules. Conceal fastenings, unless otherwise indicated. Fabricate frames of minimum 0.0478-inch- (1.2-mm-) thick cold-rolled steel sheet.
 - 1. Fabricate frames with mitered or coped and continuously welded corners.
 - 2. Fabricate frames for interior openings over 48 inches (1220 mm) wide from 0.0598-inch- (1.5-mm-) thick steel sheet.
 - 3. Form exterior frames from 0.0635-inch- (1.6-mm-) thick galvanized steel sheet.
- B. Door Silencers: Except on weatherstripped frames, drill stops to receive 3 silencers on strike jambs of single-door frames and 2 silencers on heads of double-door frames.
- C. Grout: When required in masonry construction, as specified in Division 4 Section "Unit Masonry."

2.5 FABRICATION

- A. Fabricate steel door and frame units to be rigid, neat in appearance, and free from defects, warp, or buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site. Comply with ANSI/SDI 100 requirements.
 - 1. Internal Construction: One of the following manufacturer's standard core materials according to SDI standards:
 - a. Resin-impregnated paper honeycomb.
 - b. Rigid polyurethane conforming to ASTM C 591.
 - c. Rigid polystyrene conforming to ASTM C 578.

2. Clearances: Not more than **1/8 inch (3.2 mm)** at jambs and heads, except not more than **1/4 inch (6.4 mm)** between non-fire-rated pairs of doors. Not more than **3/4 inch (19 mm)** at bottom.
 - a. Fire Doors: Provide clearances according to NFPA 80.
 - B. Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from only cold-rolled steel sheet.
 - C. Tolerances: Comply with SDI 117 "Manufacturing Tolerances Standard Steel Doors and Frames."
 - D. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.
 - E. Galvanized Steel Doors, Panels, and Frames: For the following locations, fabricate doors, panels, and frames from galvanized steel sheet according to SDI 112. Close top and bottom edges of doors flush as an integral part of door construction or by addition of minimum **0.0635-inch- (1.6-mm-)** thick galvanized steel channels, with channel webs placed even with top and bottom edges. Seal joints in top edges of doors against water penetration.
 1. At exterior locations and where indicated.
 - F. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.
 - G. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements of SDI 107 and ANSI A115 Series specifications for door and frame preparation for hardware.
 1. For concealed overhead door closers, provide space, cutouts, reinforcing, and provisions for fastening in top rail of doors or head of frames, as applicable.
 - H. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.
 - I. Locate hardware as indicated on Shop Drawings or, if not indicated, according to the Door and Hardware Institute's (DHI) "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - J. Glazing Stops: Minimum **0.0359-inch- (0.9-mm-)** thick steel or **0.040-inch- (1-mm-)** thick aluminum.
 1. Provide nonremovable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
 2. Provide screw-applied, removable, glazing beads on inside of glass, louvers, and other panels in doors.
- 2.6 FINISHES, GENERAL
- A. Comply with NAAMM's "Metal Finishes Manual" for recommendations relative to applying and designating finishes.

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- B. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for steel sheet finishes.
- C. Apply primers and organic finishes to doors and frames after fabrication.

2.7 GALVANIZED STEEL SHEET FINISHES

- A. Surface Preparation: Clean surfaces with nonpetroleum solvent so that surfaces are free of oil or other contaminants. After cleaning, apply a conversion coating of the type suited to the organic coating applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
 - 1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.
- B. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply air-dried primer specified below immediately after cleaning and pretreatment.
 - 1. Shop Primer: Zinc-dust, zinc-oxide primer paint complying with performance requirements of FS TT-P-641, Type II.

2.8 STEEL SHEET FINISHES

- A. Surface Preparation: Solvent-clean surfaces to comply with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel to comply with SSPC-SP 5 (White Metal Blast Cleaning) or SSPC-SP 8 (Pickling).
- B. Pretreatment: Immediately after surface preparation, apply a conversion coating of type suited to organic coating applied over it.
- C. Factory Priming for Field-Painted Finish: Apply shop primer that complies with ANSI A224.1 acceptance criteria, is compatible with finish paint systems indicated, and has capability to provide a sound foundation for field-applied topcoats. Apply primer immediately after surface preparation and pretreatment.

PART 3 EXECUTION

3.1 INSTALLATION

- A. General: Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.
- B. Placing Frames: Comply with provisions of SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
 - 1. Except for frames located in existing concrete, masonry, or gypsum board assembly construction, place frames before constructing enclosing walls and ceilings.

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2. In masonry construction, install at least 3 wall anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.
 3. In metal-stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. In steel-stud partitions, attach wall anchors to studs with screws.
 4. Install fire-rated frames according to NFPA 80.
- C. Door Installation: Fit hollow-metal doors accurately in frames, within clearances specified in ANSI/SDI 100.
1. Fire-Rated Doors: Install with clearances specified in NFPA 80.

3.2 ADJUSTING AND CLEANING

- A. Prime Coat Touchup: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.
- B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION 081100

Work Required:

Interior aluminum doors shall be as detailed and as manufactured by **Alpha Aluminum Products, Inc.**, 325 N. Muller St., Anaheim, CA 92801 (714) 210-1507

1. All interior aluminum doors and door systems to be provided and installed by contractor.

Materials:

Sections shall be extruded 6063-T5 aluminum alloy. Major tubular portions of door stiles and rails shall be not less than .100" in thickness and glazing moldings not less than .050" in thickness. Bottom rails shall be 9-1/2"; top rails and stiles shall be Alpha's standard wide, medium or narrow, as specified. 1/2" tall glass stops shall be for 1/4", 1/2", or 1" glass as required. All door frame casing to be 2".

Hardware:

All hardware provided and installed by contractor.

All glass provided and installed by contractor.

Workmanship:

Doors shall be completely factory assembled. Corners of doors shall be accurately joined and fitted with flush hairline joints, and tack welded on unexposed surface. Doors shall be of triple reinforced construction having reinforced anchor blocks bolted to the stiles and secured in place with lock washers. Glazing of doors shall be of bulb vinyl type and no screws shall be needed to secure glazing stops in place. All cut-outs, recesses, mortising or milling operations required for hardware shall be accurately made and reinforced with backing plates as required to insure adequate strength of the connections

Finish:

Finish shall be standard commercial clear or dark bronze anodized; or custom painted to match sample provided: VFY finish with Architect.

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SECTION 082110 - FLUSH WOOD DOORS

PART 1 - GENERAL

1..1 RELATED DOCUMENTS:

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

1..2 SUMMARY:

- A. Extent and location of each type of flush wood door is indicated on drawings and in schedules.
- B. Types of doors required include the following:
 - 1. Solid core flush wood doors with maple veneer faces.
- C. Finishing of flush wood doors is included in section 09900-Painting.
- D. Wood doorframes and other woodwork in juxtaposition to flush wood doors are specified in Division-6 section "Architectural Woodwork".

1..3 SUBMITTALS:

- A. Product Data: Door manufacturer's technical data for each type of door, including details of core and edge construction, trim for openings and louvers, and factory-finishing specifications.
- B. Shop Drawings: Submit shop drawings indicating location and size of each door, elevation of each kind of door, details of construction, location and extent of hardware blocking, fire ratings, requirements for factory finishing and other pertinent data.
 - 1. For factory-premachined doors, indicate dimensions and locations of cutouts for locksets and other cutouts adjacent to light and louver openings.

1..4 QUALITY ASSURANCE:

- A. Quality Standards: Comply with the following standards:
 - 1. NWWDA Quality Standard: I.S.1 "Industry Standard for Wood Flush Doors", of National Wood Window and Door Association (NWWDA).
 - 2. AWI Quality Standard: "Architectural Woodwork Quality Standards"; including Section 1300 "Architectural Flush Doors", of Architectural Woodwork Institute (AWI) for grade of door, core construction, finish and other requirements exceeding those of NWWDA quality standard.
- B. NWWMA Quality Marking: Mark each wood door with NWWDA Wood Flush Door Certification Hallmark certifying compliance with applicable requirements of NWWDA I.S. 1 Series.
 - 1. For manufacturers not participating in NWWDA Hallmark Program, a certification of compliance may be substituted for marking of individual doors.
- C. Fire-Rated Wood Doors: Provide wood doors which are identical in materials and construction to units tested in door and frame assemblies per ASTM E 152 and which are labeled and listed for ratings indicated by UL, Warnock Hersey or other testing and inspection agency acceptable to

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authorities having jurisdiction.

1. Oversize Fire-Rated Wood Doors: For door assemblies exceeding sizes of tested assemblies, provide manufacturer's certificate stating that doors conform to all standard construction requirements of tested and labeled fire door assemblies except as to size.

D. Manufacturer: Obtain doors from a single manufacturer.

1..5 PRODUCT DELIVERY, STORAGE, AND HANDLING:

A. Protect doors during transit, storage and handling to prevent damage, soiling and deterioration. Comply with requirements of referenced standards and recommendations of NWWDA pamphlet "How to Store, Handle, Finish, Install, and Maintain Wood Doors", as well as with manufacturer's instructions.

B. Identify each door with individual opening numbers which correlate with designation system used on shop drawings for door, frames, and hardware, using temporary, removable or concealed markings.

1..6 PROJECT CONDITIONS:

A. Conditioning: Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during remainder of construction period to comply with the following requirements applicable to project's geographical location:

1. Referenced AWI quality standard including Section 100-S-3 "Moisture Content".

1..7 WARRANTY:

A. General: Warranties shall be in addition to, and not a limitation of, other rights the Owner may have under the Contract Documents.

B. Door Manufacturer's Warranty: Submit written agreement in door manufacturer's standard form signed by Manufacturer, Installer and Contractor, agreeing to repair or replace defective doors that have warped (bow, cup or twist) or that show telegraphing of core construction in face veneers, or do not conform to tolerance limitations of referenced quality standards.

1. Warranty shall also include reinstallation which may be required due to repair or replacement of defective doors where defect was not apparent prior to hanging.
2. Warranty shall be in effect during following period of time after date of Substantial Completion.
3. Solid Core Interior Doors:

a. Life of installation.

C. Contractor's Responsibilities: Replace or refinish doors where Contractor's work contributed to rejection or to voiding of manufacturer's warranty.

PART 2 - PRODUCTS

2..1 MANUFACTURERS:

FLUSH WOOD DOORS

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- A. Manufacturer: Subject to compliance with requirements, provide products of one of the following (All others must be approved prior to bid) :
 - 1. Solid Core Doors with Wood Veneer Faces:
 - a. VT Industries, Inc.
 - b. Oshkosh Architectural Door Company

2.2 INTERIOR FLUSH WOOD DOORS:

- A. Solid Core Doors for Transparent Finish: Comply with the following requirements:
 - 1. Faces: SLICED WHITE MAPLE CLEAR FINISH
 - 2. AWI Grade: Premium.
 - 3. Construction: GP-5 (Particleboard core, 5-ply).
- B. Faces and AWI Grade: Provide faces and grade to match non-rated doors in same area of building, unless otherwise indicated.
 - 1. Construction: Manufacturer's standard core construction as required to provide fire-resistance rating indicated.
 - 2. Edge Construction: Provide manufacturer's standard laminated edge construction for improved screw-holding capability and split resistance as compared to edges composed of a single layer of treated lumber.

2.3 FACTORY FINISHING:

- A. General: Comply with referenced AWI quality standard including Section 1500 "Factory Finishing".
- B. Prefinish wood doors at factory.

PART 3 - EXECUTION

3..1 EXAMINATION:

- A. Examine installed door frames prior to hanging door:
 - 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.
 - 2. Reject doors with defects.
- B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3..2 INSTALLATION:

- A. Hardware: For installation see Division-8 "Finish Hardware" section of these specifications.
- B. Manufacturer's Instructions: Install wood doors to comply with manufacturer's instructions and of

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referenced AWI standard and as indicated.

- C. Job-Fit Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted with fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.
 - 1. Fitting Clearances for Non-Rated Doors: Provide 1/8" at jambs and heads; 1/16" per leaf at meeting stiles for pairs of doors; and 1/8" from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4" clearance from bottom of door to top of threshold.
 - 2. Bevel non-rated doors 1/8" in 2" at lock and hinge edges.
- D. Prefit Doors: Fit to frames for uniform clearance at each edge.
- E. Factory-Finished Doors: Restore finish before installation, if fitting or machining is required at the job site.

3..3 ADJUSTING AND PROTECTION:

- A. Operation: Rehang or replace doors which do not swing or operate freely.
- B. Finished Doors: Refinish or replace doors damaged during installation.
- C. Protect doors as recommended by door manufacturer to ensure that wood doors will be without damage or deterioration at time of Substantial Completion.

END OF SECTION 082110

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SECTION 084100 - ALUMINUM ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1..1 RELATED DOCUMENTS:

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

1..2 SUMMARY:

- A. Extent of aluminum entrances and storefronts is indicated on drawings and schedules.
- B. Aluminum entrances and storefront types required for the project include:
 - 1. Exterior entrance doors.
 - 2. Vestibule doors matching entrance doors.
 - 3. Frames for exterior entrances.
 - 4. Frames for interior windows.
 - 5. Storefront type framing system.
- C. Glazing: Refer to "Glass and Glazing" section of Division 8 for glazing requirements for aluminum entrances and storefronts, including doors specified to be factory-preglazed.
- D. Lock cylinders are specified in the Division-8 hardware section.

1..3 SYSTEM DESCRIPTION:

- A. Performance Requirements: Provide aluminum entrance and storefront assemblies that comply with specified performance characteristics. Each system shall be tested by a recognized testing laboratory or agency in accordance with specified test methods. Provide certified test results.
- B. Thermal Movement: Provide systems capable of withstanding thermal movements resulting from an ambient temperature range of 120 deg.F (67 deg.C), that could cause a metal surface temperature range of 180 deg.F (100 deg.C) within the framing system.
- C. Wind Loading: Provide assemblies capable of withstanding a uniform test pressure of 20 psf inward and 20 psf outward when tested in accordance with ASTM E 330.
- D. Fixed Framing Transmission Characteristics: Provide aluminum entrance and storefront framing system that complies with requirements indicated for transmission characteristics.
 - 1. Air Infiltration: Provide framing system with an air infiltration rate of not more than 0.06 CFM per sq. ft. of fixed area (excluding operable door edges) when tested in accordance with ASTM E 283 at an inward test pressure differential of 6.24 psf.
 - 2. Water Penetration: Provide framing systems with no water penetration (excluding operable door edges) as defined in the test method when tested in accordance with ASTM E 331 at an inward test pressure differential of 6.24 lbf. per sq. ft.
 - 3. Condensation Resistance: Where framing systems are "thermal- break" construction, provide units tested for thermal performance in accordance with AAMA 1502 showing condensation resistance factor (CRF) of not less than 45.
 - 4. Thermal Transmittance: Provide framing systems that have an overall U-Value of not more than 0.65 BTU/(hr. x sq. ft. x deg.F) at 15 mph exterior wind velocity when tested in accordance with AAMA 1503.
- E. Aluminum Entrances Transmission Characteristics: Provide entrance doors with jamb and head frames that comply with requirements indicated for transmission characteristics.

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1. Air Infiltration: Provide doors with an air infiltration rate of not more than 0.50 CFM for single doors and 1.0 for pairs of doors when tested in accordance with ASTM E 283 at an inward test pressure differential of 1.567 psf.
2. Condensation Resistance: Provide entrance door units tested for thermal performance in accordance with AAMA 1502 showing a condensation resistance factor (CRF) of not less than 48.
3. Thermal Transmittance: Provide entrance doors that have an overall U-value of not more than 0.93 BTU/(hr. x sq. ft. x deg.F) at 15 mph exterior wind velocity when tested in accordance with AAMA 1503.

1..4 SUBMITTALS:

- A. Product Data: Submit manufacturer's product specifications, technical product data, standard details, and installation recommendations for each type of entrance and storefront product required. Include the following information:
 1. Fabrication methods.
 2. Finishing.
 3. Hardware.
 4. Accessories.
- B. Shop Drawings: Submit shop drawings for fabrication and installation of entrances and storefronts, including the following:
 1. Elevations.
 2. Detail sections of typical composite members.
 3. Hardware, mounting heights.
 4. Anchorages and reinforcements.
 5. Expansion provisions.
 6. Glazing details.
- C. Samples: Submit pairs of samples of each type and color of aluminum finish, on 12" long sections of extrusions or formed shapes and on 6" square sheets. Where color or texture variations are anticipated, include 2 or more units in each set of samples indicating extreme limits of variations.
- D. Certification: Provide certified test results showing that entrance and storefront systems have been tested by a recognized testing laboratory or agency and comply with specified performance characteristics.

1..5 QUALITY ASSURANCE:

- A. Single Source Responsibility: Provide entrance and storefront produced by a single manufacturer capable of showing prior production of units similar to those required.
- B. Manufacturer's Qualifications: Provide entrances and storefront produced by a single manufacturer with not less than 5 years successful experience in the fabrication of assemblies of the type and quality required.
- C. Installer's Qualifications: Entrances and storefront shall be installed by a firm that has not less than 5-years successful experience in the installation of systems similar to those required.
- D. Design Criteria: Drawings are based on one manufacturer's entrance and storefront system. Another manufacturer's system of a similar and equivalent nature will be acceptable when, in the Architect's sole judgement, differences do not materially detract from the design concept or intended

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performance.

1..6 PROJECT CONDITIONS:

- A. Field Measurements: Check openings by field measurement before fabrication to ensure proper fitting of work; show measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay in the work. Where necessary, proceed with fabrication without field measurements, and coordinate fabrication tolerances to ensure proper fit.

1..7 WARRANTY:

- A. Special Project Warranty: Submit a written warranty, executed by the Contractor, Installer and Manufacturer, agreeing to repair or replace units (including reglazing) which fail in materials or workmanship within the specified warranty period. Failures include, but are not necessarily limited to structural failures including excessive deflection, excessive leakage or air infiltration, faulty operation, and deterioration of metals, metal finishes and other materials beyond normal weathering. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.
 - 1. Warranty period for aluminum entrances and storefront is 3 years after the date of substantial completion.

PART 2 - PRODUCTS

2..1 MANUFACTURERS:

- A. Available Manufacturers:
 - 1. Tubelite.
 - 2. Kawneer.

2..2 MATERIALS:

- A. Aluminum Members: Provide alloy and temper recommended by the manufacturer for strength, corrosion resistance, and application of required finish; comply with ASTM B 221 for extrusions and ASTM B 209 for sheet or plate.
- B. Fasteners: Provide fasteners of aluminum, nonmagnetic stainless steel, or other materials warranted by the manufacturer to be noncorrosive and compatible with aluminum components, hardware, anchors and other components.
 - 1. Reinforcement: Where fasteners screw-anchor into aluminum less than 0.125" thick, reinforce the interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard noncorrosive pressed-in splined grommet nuts.
 - 2. Exposed Fasteners: Except where unavoidable for application of hardware, do not use exposed fasteners. For the application of hardware, use fasteners that match the finish of member or hardware being fastened.
 - a. Provide Phillips flat-head machine screws for exposed fasteners.
- C. Concealed Flashing: Provide 26 gage minimum dead-soft stainless steel, or 0.026" minimum extruded aluminum of alloy and type selected by manufacturer for compatibility with other components.

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- D. Brackets and Reinforcements: Where feasible, provide high-strength aluminum brackets and reinforcements; otherwise provide nonmagnetic stainless steel or hot-dip galvanized steel complying with ASTM A 386.
- E. Compression Weatherstripping: Provide the manufacturer's standard replaceable compressible weatherstripping gaskets of molded neoprene complying with ASTM D 2000 or molded PVC complying with ASTM D 2287.
- F. Sliding Weatherstripping: Provide the manufacturer's standard replaceable weatherstripping of wool, polypropylene, or nylon woven pile, with nylon fabric or aluminum strip backing, complying with AAMA 701.2.
- G. Glass and Glazing Materials: Glass and glazing materials shall comply with requirements of "Glass and Glazing" section of these specifications.

2..3 COMPONENTS:

- A. Storefront Framing System: Provide inside-outside matched resilient flush-glazed storefront framing system with provisions for glass replacement. Shop-fabricate and preassemble frame components where possible.
 - 1. Thermal-Break Construction: Fabricate storefront framing system with integrally concealed, low conductance thermal barrier, located between exterior materials and exposed interior members to eliminate direct metal-to-metal contact. Use manufacturer's standard construction that has been in use for similar projects for period of not less than 3 years.
- B. Aluminum Door Frames: Fabricate tubular and channel frame assemblies, as indicated, with welded or mechanical joints in accordance with manufacturer's standards; reinforce as necessary to support required loads.
- C. Stile-and-Rail Type Aluminum Doors:
 - 1. Frame: Provide tubular frame members, fabricated with mechanical joints using heavy inserted reinforcing plates and concealed tie-rods of j-bolts.
 - 2. Design: Provide 1-3/4" thick doors of design indicated.
 - a. Medium stile (3-1/2" nominal width).
 - 3. Glazing: Fabricate doors to facilitate replacement of glass or panels, without disassembly of stiles and rails. Provide snap-on extruded aluminum glazing stops, with exterior stops anchored for non-removal.

2..4 HARDWARE:

- A. General: Refer to hardware section of Division-8 for requirements for hardware items other than those indicated to be provided by the aluminum entrance manufacturer.
- B. Provide manufacturer's heavy-duty hardware units as indicated, scheduled, or required for operation of each door, including the following items of sizes, number, and type recommended by manufacturer for service required, finished to match door.
 - 1. Ball-Bearing Butts: Provide 5-knuckle, 2-bearings, steel ball bearing butts sized to comply with ANSI A156.1, Grade 1; provide 2 butts for doors 7'-6" or less, 3 for taller doors.
 - a. Delayed action closing.
 - 2. Closers: Provide independently hung, LCN Series 4000 closer to match storefront.

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3. Flushbolts: Provide standard edge mortised lever extension type flush bolts complying with ANSI A 156.16, for inactive leaves of pairs of doors. Provide flushbolts at both the top and bottom of doors.
4. Push Bars: Provide the manufacturer's standard full door width single bar push bar.
5. Thresholds: Provide extruded aluminum threshold of size and design indicated in mill finish, complete with anchors and clips, coordinated with pivots and floor-concealed closers.

2..5 FABRICATION:

- A. General: Sizes of door and frame units, and profile requirements, are indicated on drawings. Variable dimensions are indicated, with maximum and minimum dimensions required to achieve design requirements and coordination with other work.
- B. Prefabrication: Before shipment to the project site, complete fabrication, assembly, finishing, hardware application, and other work to the greatest extent possible. Disassemble components only as necessary for shipment and installation.
 1. Preglaze door and frame units to greatest extent possible.
 2. Do not drill and tap for surface-mounted hardware items until time of installation at project site.
 3. Perform fabrication operations, including cutting, fitting, forming, drilling and grinding of metal work to prevent damage to exposed finish surfaces. For hardware, perform these operations prior to application of finishes.
- C. Welding: Comply with AWS recommendations; grind exposed welds smooth and restore mechanical finish.
- D. Reinforcing: Install reinforcing as required for hardware and necessary for performance requirements, sag resistance and rigidity.
- E. Dissimilar Metals: Separate dissimilar metals with zinc chromate primer, bituminous paint, or other separator that will prevent corrosion.
- F. Continuity: Maintain accurate relation of planes and angles, with hairline fit of contacting members.
 1. Uniformity of Finish: Abutting extruded aluminum members shall not have an integral color or texture variation greater than half the range indicated in the sample pair submittal.
- G. Fasteners: Conceal fasteners wherever possible.
- H. Weatherstripping: For exterior doors, provide compression weatherstripping against fixed stops; at other edges, provide sliding weatherstripping retained in adjustable strip mortised into door edge.
 1. Provide EPDM or vinyl blade gasket weatherstripping in bottom door rail, adjustable for contact with threshold.
 2. At interior doors and other locations without weatherstripping, provide neoprene silencers on stops to prevent metal-to-metal contact.
- I. Provide finger guards of collapsible neoprene or PVC gasketing securely anchored into frame at hinge-jamb of center-pivoted doors.

2..6 FINISHES:

- A. Color Anodized Finish: Provide NAAMM AA-M12C22A41/A44, Class I (non-specular as fabricated mechanical finish; chemical etch, medium matte; minimum thickness 0.7 mil) integrally or electrolytically deposited colored anodic coating.
 1. Color: Architect to select from full range of manufactures colors.

PART 3 - EXECUTION

3..1 INSTALLATION:

- A. Comply with manufacturer's instructions and recommendations for installation.
- B. Set units plumb, level, and true to line, without warp or rack of framing members, doors, or panels. Provide proper support and anchor securely in place.
 - 1. Separate aluminum and other corrodible metal surfaces from sources of corrosion of electrolytic action at points of contact with other materials. Comply with requirements specified under paragraph "Dissimilar Materials" in the Appendix to AAMA 101-85.
- C. Drill and tap frames and doors and apply surface-mounted hardware items. Comply with hardware manufacturer's instructions and template requirements. Use concealed fasteners wherever possible.
- D. Set sill members and other members in bed of sealant as indicated, or with joint fillers or gaskets as indicated to provide weathertight construction. Comply with requirements of Division 7 for sealants, fillers, and gaskets.
- E. Refer to "Glass and Glazing" section of Division 8 for installation of glass and other panels indicated to be glazed into doors and framing, and not preglazed by manufacturer.

3..2 ADJUSTING:

- A. Adjust operating hardware to function properly, for smooth operation without binding, and for weathertight closure.

3..3 CLEANING:

- A. Clean the completed system, inside and out, promptly after installation, exercising care to avoid damage to coatings.
- B. Clean glass surfaces after installation, complying with requirements contained in the "Glass and Glazing" section for cleaning and maintenance. Remove excess glazing and sealant compounds, dirt and other substances from aluminum surfaces.

3..4 PROTECTION:

- A. Institute protective measures required throughout the remainder of the construction period to ensure that aluminum entrances and storefronts will be without damage or deterioration, other than normal weathering, at time of acceptance.

END OF SECTION 084100

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SECTION 087100 - FINISH HARDWARE

PART 1 - GENERAL

1..1 RELATED DOCUMENTS:

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

1..2 DESCRIPTION OF WORK:

- A. Definition: "Finish Hardware" includes items known commercially as finish hardware which are required for swing, sliding and folding doors, except special types of unique and non-matching hardware specified in the same section as the door and door frame.
- B. Extent of finish hardware required is indicated on drawings and in schedules.
- C. Types of finish hardware required include the following:
 - 1. Hinges
 - 2. Lock cylinders and keys
 - 3. Lock and latch sets
 - 4. Exit devices
 - 5. Push/pull units
 - 6. Closers
 - 7. Protection plates
- D. Silencers included integral with hollow metal frames specified with door frames elsewhere in Division 8.

1..3 QUALITY ASSURANCE:

- A. Manufacturer: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.
- B. Supplier: A recognized architectural finish hardware supplier, with warehousing facilities, who has been furnishing hardware in the project's vicinity for a period of not less than 2 years, and who is, or who employs an experienced architectural hardware consultant who is available, at reasonable times during the course of the work, for consultation about project's hardware requirements, to Owner, Architect and Contractor.

1..4 SUBMITTALS:

- A. Product Data: Submit manufacturers technical product data for each item of hardware in accordance with Division-1 section "Submittals". Include whatever information may be necessary to show compliance with requirements, and include instructions for installation and for maintenance of operating parts and finishes.
- B. Hardware Schedule: Submit final hardware schedule in manner indicated below. Coordinate hardware with doors, frames and related work to ensure proper size, thickness, hand, function and finish of hardware.
 - 1. Final Hardware Schedule Content: Based on finish hardware indicated, organize hardware

schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:

- a. Type, style, function, size and finish of each hardware item.
 - b. Name and manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.
 - e. Explanation of all abbreviations, symbols, codes, etc. contained in schedule.
 - f. Mounting locations for hardware.
 - g. Door and frame sizes and materials.
 - h. Keying information.
2. Submittal Sequence: Submit schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work (e.g., hollow metal frames) which is critical in the project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by finish hardware, and other information essential to the coordinated review of hardware schedule.
 3. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.
- C. Samples: Prior to submittal of the final hardware schedule and prior to final ordering of finish hardware, submit one sample of each type of exposed hardware unit, finished as required, and tagged with full description for coordination with schedule.
1. Samples will be returned to the supplier. Units which are acceptable and remain undamaged through submittal, review and field comparison procedures may, after final check of operation, be used in the work, within limitations of keying coordination requirements.
- D. Templates: Furnish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of hardware. Upon request, check shop drawings of such other work, to confirm that adequate provisions are made for proper location and installation of hardware.

1.5 PRODUCT HANDLING:

- A. Tag each item or package separately, with identification related to final hardware schedule, and include basic installation instructions with each item or package.
- B. Packaging of hardware is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packaged in same container.
- C. Inventory hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.
- D. Deliver individually packaged hardware items at the proper times to the proper locations (shop or project site) for installation.
- E. Provide secure lock-up for hardware delivered to the project, but not yet installed. Control handling and installation of hardware items which are not immediately replaceable, so that completion of the work will not be delayed by hardware losses, both before and after installation.

PART 2 - PRODUCTS

2..1 HARDWARE ALLOWANCE:

- A. Selection and Ordering: Furnish finish hardware as selected by Architect and in such amounts as provided for under Allowances in Division 1 and other general provisions of the Contract.
- B. Responsibilities of Finish Hardware Supplier:
 - 1. Submittals: Provide through Contractor required Product Data, Final Hardware Schedule, Separate Keying Schedule (if required), and samples as specified in Part 1 - General of this section, unless otherwise indicated.
 - 2. Construction Schedule: Inform Contractor at earliest possible date of estimated times and dates to process submittals, to furnish templates, to deliver hardware, and to perform other work associated with furnishing Finish Hardware for purposes of including in construction progress schedule and then comply with this schedule.
 - 3. Coordination and Templates: Assist Contractor as required to coordinate hardware with other work in respect to both fabrication and installation. Furnish Contractor with templates and deliver hardware to proper locations.
 - 4. Product Handling: Package, identify, deliver, and inventory hardware as specified in Part 1 - General of this section.
 - 5. Discrepancies: Based on requirements indicated in Contract Documents in effect at time of hardware selection, furnish proper types, finishes, and quantities of finish hardware, including fasteners, and Owner's maintenance tools; and furnish or replace any items of finish hardware resulting from shortages and incorrect items, at no cost to the Owner or Contractor. Obtain signed receipts from Contractor for all delivered materials.
- C. Responsibilities of Contractor:
 - 1. Submittals: Coordinate and process submittals for Finish Hardware in same manner as submittals for other work.
 - 2. Construction Schedule: Cooperate with Finish Hardware supplier in establishing scheduled dates for submittals and delivery of templates and finish hardware.
 - 3. Coordination: Coordinate finish hardware with other work. Furnish hardware supplier or manufacturer with shop drawings of other work where required or requested. Verify completeness and suitability of hardware with supplier.
 - 4. Product Handling: Provide secure lock-up for hardware delivered to the site. Inventory hardware jointly with representative of hardware supplier and issue signed receipts for all delivered materials. Any hardware items lost, damaged or stolen after being accepted by Contractor shall be replaced at Contractor's expense.
 - 5. Installation Information: The general types and approximate quantities of hardware required for this project are indicated at the end of this section in order to establish Contractor's costs for installation and other work not included in allowances.
 - a. No adjustments in Contract sum will be made for costs other than those covered by the allowances for subsequent increases or decreases in quantity of one or more hardware types which do not exceed 5 percent.

2..2 SCHEDULED HARDWARE:

- A. Requirements for design, grade, function, finish, size and other distinctive qualities of each type of finish hardware is indicated in the Finish Hardware Data Sheet and Hardware Schedule at the end of this section. Products are identified by using hardware designation numbers of the following:
 - 1. Manufacturer's Product Designations: One or more manufacturers are listed for each

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hardware type required. An asterisk (*) after a manufacturer's name indicates whose product designation is used in the Hardware Schedule for purposes of establishing minimum requirements. Provide either the product designated, or, where more than one manufacturer is listed, the comparable product of one of the other manufacturers which comply with requirements including those specified elsewhere in this section.

2. ANSI/BHMA designations used elsewhere in this section or in schedules to describe hardware items or to define quality or function are derived from the following standards. Provide products complying with these standards and requirements specified elsewhere in this section.
 - a. Butts and Hinges: ANSI A156.1 (BHMA 101)
 - b. Locks and Lock Trim: ANSI A156.2 (BHMA 601)
 - c. Exit Devices: ANSI A156.3 (BHMA 701)
 - d. Door Controls - Closers: ANSI A156.4 (BHMA 301)
 - e. Template Hinge Dimensions: ANSI A156.7
 - f. Locks & Latches: ANSI A156.13 (BHMA 621)

2..3 MATERIALS AND FABRICATION:

A. General:

1. Hand of door: Drawings show direction of slide, swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
2. Manufacturer's Name Plate: Do not use manufacturer's products which have manufacturer's name or trade name displayed in a visible location (omit removable nameplates), except in conjunction with required UL labels and as otherwise acceptable to Architect.
 - a. Manufacturer's identification will be permitted on rim of lock cylinders only.
 - b. Base Metals: Produce hardware units of basic metal and forming method indicated, using manufacturer's standard metal alloy, composition, temper and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units by applicable ANSI A156 series standard for each type hardware item and with ANSI A156.18 for finish designations indicated. Do not furnish "optional" materials or forming methods for those indicated, except as otherwise specified.
3. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware which has been prepared for self-tapping sheet metal screws, except as specifically indicated.
4. Furnish screws for installation, with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of such other work as closely as possible, including "prepared for paint" in surfaces to receive painted finish.
5. Provide concealed fasteners for hardware units which are exposed when door is closed, except to extent no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work, except where it is not feasible to adequately reinforce the work. In such cases, provide sleeves for each thru-bolt or use sex screw fasteners.
6. Tools and Maintenance Instructions for Maintenance: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of finish hardware.

2..4 HINGES, BUTTS AND PIVOTS:

- A. Templates: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and

frames, provide only template- produced units.

- B. Screws: Furnish Phillips flat-head or machine screws for installation of units, except furnish Phillips flat-head or wood screws for installation of units into wood. Finish screw heads to match surface of hinges or pivots.
- C. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - 1. Non-ferrous Hinges: Stainless steel pins.
 - 2. Exterior Doors: Non-removable pins.
 - 3. Out-swing Corridor Doors: Non-removable pins.
 - 4. Interior Doors: Non-rising pins.
 - 5. Tips: Flat button and matching plug, finished to match leaves.
 - 6. Number of hinges: Provide number of hinges indicated but not less than 3 hinges for door leaf for doors 90" or less in height and one additional hinge for each 30" of additional height.

2..5 LOCK CYLINDERS AND KEYING:

- A. General: Supplier will meet with Owner to finalize keying requirements and obtain final instructions in writing.
- B. Existing System: Grandmasterkey the locks to the Owner's existing system, with a new masterkey for the project.
- C. Equip locks with manufacturer's standard 6-pin tumbler cylinders.
- D. Metals: Construct lock cylinder parts from brass/bronze, stainless steel or nickel silver.
- E. Comply with Owner's instructions for masterkeying and, except as otherwise indicated, provide individual change key for each lock which is not designated to be keyed alike with a group of related locks.
 - 1. Permanently inscribe each key with number or lock that identifies cylinder manufacturer key symbol, and notation "DO NOT DUPLICATE".
- F. Key Material: Provide keys of nickel silver only.
- G. Key Quantity: Furnish 3 change keys for each lock; 5 master keys for each master system; and 5 grandmaster keys for each grandmaster system.
 - 1. Furnish one extra blank for each lock.
 - 2. Deliver keys to Owner's representative.

2..6 LOCKS, LATCHES AND BOLTS:

- A. Strikes: Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set.
 - 1. Provide standard (open) strike plates for interior doors of residential units where wood door frames are used.
 - 2. Provide dust-proof strikes for foot bolts, except where special threshold construction provides non-recessed strike for bolt.
 - 3. Provide roller type strikes where recommended by manufacturer of the latch and lock units.
- B. Lock Throw: Provide 5/8" minimum throw of latch and deadbolt used on pairs of doors. Comply with UL requirements for throw of bolts and latch bolts on rated fire openings.

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1. Provide 1/2" minimum throw on other latch and deadlock bolts.
- C. Flush Bolt Heads: Minimum of 1/2" diameter rods of brass, bronze or stainless steel, with minimum 12" long rod for doors up to 7'-0" in height. Provide longer rods as necessary for doors exceeding 7'-0" in height.
 - D. Exit Device Dogging: Except on fire-rated doors, wherever closers are provided on doors equipped with exit devices, equip the units with keyed dogging device to hold the push bar down and the latch bolt in open position.
- 2..7 PUSH/PULL UNITS:
- A. Exposed Fasteners: Provide manufacturer's standard exposed fasteners for installation; through-bolted for matched pairs, but not for single units.
- 2..8 CLOSERS AND DOOR CONTROL DEVICES:
- A. Size of Units: Except as otherwise specifically indicated, comply with the manufacturer's recommendations for size of door control unit, depending upon size of door, exposure to weather and anticipated frequency of use.
 - B. Access-Free Manual Closers: Where manual closers are indicated for doors required to be accessible to the physically handicapped, provide adjustable units complying with ANSI A117.1 provisions for door opening force and delayed action closing.
 - C. Provide black resilient parts for exposed bumpers.
- 2..9 DOOR TRIM UNITS:
- A. Fasteners: Provide manufacturer's standard exposed fasteners for door trim units (kick plates, edge trim, viewers, knockers, mail drops and similar units); either machine screws or self-tapping screw.
 - B. Fabricate edge trim of stainless steel, not more than 1/2" nor less than 1/16" smaller in length than door dimension.
 - C. Fabricate protection plates (armor, kick or mop) not more than 1- 1/2" less than door width on stop side and not more than 1/2" less than door width on pull side, x the height indicated.
 1. Metal Plates: Stainless steel, .050" (U.S. 18 ga.).
- 2..10 HARDWARE FINISHES:
- A. Provide matching finishes for hardware units at each door or opening, to the greatest extent possible, and except as otherwise indicated. Reduce differences in color and textures as much as commercially possible where the base metal or metal forming process is different for individual units of hardware exposed at the same door or opening. In general, match items to the manufacturer's standard finish for the latch and lock set (or push-pull units if no latch-lock sets) for color and texture.
 - B. Provide finishes which match those established by BHMA or, if none established, match the Architect's sample.
 - C. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness and other qualities complying with manufacturer's standards, but in no case less than specified for the

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applicable units of hardware by referenced standards.

- D. Provide protective lacquer coating on all exposed hardware finishes of brass, bronze and aluminum, except as otherwise indicated. The suffix "-NL" is used with standard finish designations to indicate "no lacquer".
- E. The designations used in schedules and elsewhere to indicate hardware finishes are those listed in ANSI A156.18 "Materials & Finishes Standard", including coordination with the traditional U.S. finishes shown by certain manufacturers for their products.
- F. The designations used in schedules and elsewhere to indicate hardware finishes are the industry-recognized standard commercial finishes, except as otherwise noted.
 - 1. Rust-Resistant Finish: For iron and steel base metal, required for exterior work and in areas shown as "High Humidity" areas (and also when designed with the suffix -RR), provide 0.2 mil thick copper coating on base metal before applying brass, bronze, nickel or chromium plated finishes.

PART 3 - EXECUTION

3..1 INSTALLATION:

- A. Mount Hardware units at heights indicated in "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute, except as specifically indicated or required to comply with governing regulations, and except as may be otherwise directed by Architect.
- B. Mount hardware units at heights indicated in "Recommended Locations for Builders Hardware for Custom Steel Doors and Frames" by the Door and Hardware Institute, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by Architect.
- C. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protections with finishing work specified in the Division-9 sections. Do not install surface-mounted items until finishes have been completed on the substrate.
- D. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- F. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant.

3..2 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 surfaces soiled by hardware installation.
- C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance

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or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

- D. Instruct Owner's Personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.
- E. Continued Maintenance Service: Approximately six months after the acceptance of hardware in each area, the Installer, accompanied by the representative of the latch and lock manufacturer, shall return to the project and re-adjust every item of hardware to restore proper function of doors and hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

See Specific Hardware requirements on Door Schedule sheet within drawings.

END OF SECTION 087100

SECTION 087160 - AUTOMATIC DOOR OPERATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following types of automatic door operators:
 - 1. Exterior and interior, automatic door operators, high energy, with visible mounting.
 - 2. Automatic door operators shall be configured for doors as follows: Simultaneous pairs, with single operator, out swing.
- B. Related Sections:
 - 1. Division 8 Section "Doors and Frames" for entrances furnished and installed separately in Division 8 Section.
 - 2. Division 8 Section "Aluminum-Framed Entrances and Storefronts" for entrances furnished and installed separately in Division 8 Section.
 - 3. Division 8 Section "Door Hardware" for hardware to the extent not specified in this Section.
 - 4. Division 26 [16] Sections for electrical connections provided separately in Division 26 [16] Section including conduit and wiring for power to, and control of, automatic door operators.

1.3 REFERENCES

- A. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.
- B. Underwriters Laboratories (UL):
 - 1. UL 325 – Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.
 - 2. UL 10C – Positive Pressure Fire Tests of Door Assemblies
- C. American National Standards Institute (ANSI)/Builders' Hardware Manufacturers Association (BHMA):
 - 1. ANSI/BHMA A156.10: Standard for Power Operated Pedestrian Doors.
 - 2. ANSI/BHMA A156.19: Standard for Power Assist and Low Energy Power Operated Doors.
- D. American Society for Testing and Materials (ASTM):
 - 1. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 2. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- E. American Association of Automatic Door Manufacturers (AAADM):
- F. National Fire Protection Association (NFPA):

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1. NFPA 101 – Life Safety Code.
2. NFPA 70 – National Electric Code.

- G. International Code Council (ICC):
1. IBC: International Building Code

- H. Building Officials and Code Administrators International (BOCA), 1999:

- I. International Standards Organization (ISO):
1. ISO 9001 - Standard for Manufacturing Quality Management Systems

- J. National Association of Architectural Metal Manufacturers (NAAMM):
1. Metal Finishes Manual for Architectural and Metal Products.

- K. American Architectural Manufacturers Association (AAMA):
1. AAMA 611 Voluntary Specification for Anodized Architectural Aluminum.

1.4 DEFINITIONS

- A. Activation Device: Device that, when actuated, sends an electrical signal to the door operator to open the door.

1.5 PERFORMANCE REQUIREMENTS

- A. General: Provide automatic door operators capable of withstanding loads and thermal movements based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Operating Range: Minus 30 deg F (Minus 34 deg C) to 130 deg F (54 deg C).
- C. Opening-Force Requirements for Egress Doors: In the event power failure to the operator, swinging automatic entrance doors shall open with a manual force, not to exceed 30 lbf (133 N) applied at 1" (25 mm) from the latch edge of the door.
- D. Break Away Requirements: Automatic door operators shall breakaway with no more than 30 lbf (133 N) applied at 1" (25 mm) from the latch edge of the door.

1.6 SUBMITTALS

- A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 01 submittal procedures.
- B. Shop Drawings: Include plans, elevations, sections, details, hardware mounting heights, and attachments to other work. Indicate wiring for electrical supply.
- C. Color Samples for selection of factory-applied color finishes.
- D. Closeout Submittals: Provide the following with project close-out documents.
1. Owner's Manual.
 2. Warranties.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative, with certificate issued by AAADM, who is trained for installation and maintenance of units required for this Project.

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- B. Manufacturer Qualifications: A qualified manufacturer with a manufacturing facility certified under ISO 9001.
- C. Manufacturer shall have in place a national service dispatch center providing 24 hours a day, 7 days a week, emergency call back service.
- D. Certifications: Automatic door operators shall be certified by the manufacturer to meet performance design criteria in accordance with the following standards:
 - 1. ANSI/BHMA A156.10 and A156.19.
 - 2. NFPA 101.
 - 3. UL 325 Listed.
 - 4. UL 10C Listed.
 - 5. IBC 2009
 - 6. BOCA
- E. Source Limitations: Obtain automatic door operators through one source from a single manufacturer.
- F. Product Options: Drawings indicate sizes, profiles, and dimensional requirements of swinging doors equipped with automatic door operators and are based on the specific system indicated. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- G. Power Operated Door Standard: ANSI/BHMA A156.19.
- H. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- I. Emergency-Exit Door Requirements: Comply with requirements of authorities having jurisdiction for swinging automatic entrance doors serving as a required means of egress.

1.8 PROJECT CONDITIONS

- A. Field Measurements: General Contractor shall verify openings to receive automatic door operators by field measurements before fabrication and indicate measurements on Shop Drawings.
- B. Mounting Surfaces: General Contractor shall verify all surfaces to be plumb, straight and secure; substrates to be of proper dimension and material.
- C. Other trades: General Contractor Advise of any inadequate conditions or equipment.

1.9 COORDINATION

- A. Templates: Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing automatic door operators to comply with indicated requirements.
- B. Electrical System Roughing-in: Coordinate layout and installation of automatic door operators with connections to, power supplies, and remote activation devices.

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1.10 WARRANTY

- A. Automatic door operators shall be free of defects in material and workmanship for a period of one (1) year from the date of substantial completion.
- B. During the warranty period the Owner shall engage a factory-trained technician to perform service and affect repairs. A safety inspection shall be performed after each adjustment or repair and a completed inspection form shall be submitted to the Owner.
- C. During the warranty period all warranty work, including but not limited to emergency service, shall be performed during normal working hours.

PART 2 - PRODUCTS

2.1 AUTOMATIC DOOR OPERATORS

- A. Manufacturer: DORMA ED900 SERIES automatic door operator.
 - 1. Contact: Craig Foster with Brad Steele & Assoc
[801-967-5885](tel:801-967-5885) Office, [801-557-8159](tel:801-557-8159) Mobile
- B. Substitutions: See Division 1, Section 01 25 00 [01250] Substitution Procedures.

2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Headers: 6063-T6.
 - 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - 3. Sheet and Plate: ASTM B 209.

2.3 COMPONENTS

- A. Header Case: Header case shall not exceed 6" (152 mm) square in section and shall be fabricated from extruded aluminum with structurally integrated end caps, designed to conceal door operators and controls. The operator shall be sealed against dust, dirt, and corrosion within the header case. Access to the operator and electronic control box shall be provided by a full-length removable cover, edge rabbetted to the header to ensure a flush fit. Removable cover shall be secured to prevent unauthorized access.
- B. Door Arms: A combination of door arms and linkage shall provide positive control of door through entire swing; units shall permit use of butt hung, center pivot, and offset pivot-hung doors.
- C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.
- D. Signage: Provide signage in accordance with ANSI/BHMA A156.19.

2.4 SWINGING DOOR OPERATORS

- A. General: Provide door operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated.

- B. Electromechanical Operators: Self-contained unit powered by a minimum 3/16 horsepower, permanent-magnet DC motor; through a high torque reduction gear system.
 - 1. Operation: Power opening and spring closing.
 - 2. Operator Type: high energy; readily convertible to full energy; no tools required to change type.
 - 3. Handing: Non-handed; no tools required to change handing.
 - 4. Capacity: Rated for door panels weighing up to 350 lb (159 kg).
 - 5. Mounting: Visible
 - 6. Features:
 - a. Adjustable opening and closing speeds.
 - b. Adjustable opening and closing force.
 - c. Adjustable back-check.
 - d. Adjustable hold-open time between 0 and 30 seconds.
 - e. Reverse on obstruction.
 - f. Closed loop speed control with active braking and acceleration.
 - g. Variable obstruction recycle time delay.
 - h. Optional Switch to open/Switch to close operation.
 - i. When operators are provided in pairs, adjustable features are independently adjustable for each operator.
- C. Field Adjustable Spring Closing Operation: The operator shall close the door by spring energy employing the motor, as a dynamic brake to provide closing speed control. The closing spring shall be a helical compression spring, adjustable for positive closing action. The spring shall be adjustable, without removing the operator from the header, to accommodate a wide range of field conditions.
- D. Independent Adjustable Closing and Latching Speed Control: The operator shall employ a rheostat module to allow for independent field adjustment of closing and latching speeds using the motor as a dynamic brake.
- E. Field Adjustable Open Stop: The operator shall provide a field adjustable open stop to accommodate opening angles from 80 to 135 degrees without the need for additional components.
- F. Consistent Cycle: The operator shall deliver an even, consistent open force across the entire transition from door fully closed to door fully open. Additionally, the range of the force shall be field adjustable to accommodate a wide range of on-site conditions.
- G. Quiet Performance: The operator shall be designed to output audible noise ratios less than or equal to 50dba.
- H. Manual Use: The operator shall function as a manual door closer in the direction of swing with or without electrical power. The operator shall deliver an even, consistent open force across the entire transition from door fully closed to door fully open.
- I. Electrical service to door operators shall be provided under Division 16 Electrical. Minimum service to be 120 VAC, 10 amps for doors with operators in pairs, 5 amps for single doors.

2.5 ELECTRICAL CONTROLS

- A. Electrical Control System: Electrical control system shall include a microprocessor controller and position encoder. The encoder shall monitor revolutions of the operator shaft and send signals to microprocessor controller to define door position. Systems utilizing external magnets and magnetic switches are not acceptable.

- B. Life Cycle Data Counter: The microprocessor control shall incorporate a non-re-settable counter to track door operation cycles.
- C. Controller Protection: The microprocessor controller shall incorporate the following features to ensure trouble free operation:
 - 1. Automatic Reset Upon Power Up.
 - 2. Main Fuse Protection.
 - 3. Electronic Surge Protection.
 - 4. Internal Power Supply Protection.
 - 5. Resettable sensor supply fuse protection.
 - 6. Motor Protection, over-current protection.
- D. Push Button Interface: The controller shall have push button switches with two digit LED readout to allow for selection or change of the following parameters: carpet or timer logic, single or dual door, activation options, normal back check or large back check, push-to-open assist on/off.
- E. Soft Start/Stop: A “soft-start” “soft-stop” motor driving circuit shall be provided for smooth normal opening and recycling.
- F. Obstruction Recycle: Provide system to recycle the swinging panels when an obstruction is encountered during the closing cycle. If an obstruction is detected, the system shall search for that object on the next closing cycle by reducing door closing speed prior to the previously encountered obstruction location, and will continue to close in check speed until doors are fully closed, at which time the doors will reset to normal speed. If obstruction is encountered again, the door will come to a full stop. The doors shall remain stopped until obstruction is removed and operate signal is given, resetting the door to normal operation.
- G. Programmable Controller: Microprocessor controller shall be programmable and shall be designed for connection to a local configuration tool. Local configuration tool shall be software driven and shall be utilized via Palm® handheld interface. The following parameters may be adjusted via the configuration tool.
 - 1. Operating speeds and forces as required to meet ANSI/BHMA A156.10 A156.19.
 - 2. Adjustable and variable features as specified in 2.4, B.
 - 3. Firmware update.
 - 4. Trouble Shooting
 - a. I/O Status.
 - b. Electrical component monitoring including parameter summary.
 - 5. Software for local configuration tool shall be available as a free download from the automatic door operator manufacturer’s internet site.
- H. Emergency Breakout Switch: A cam actuated emergency breakout switch shall be provided to disconnect power to the motor when an in-swinging door is manually pushed in the emergency out direction. The operator will then automatically reset and power will be resumed.
- I. Control Switch: Automatic door operators shall be equipped with a three position function switch to control the operation of the door. Control switch shall provide three modes of operation, Automatic, Off, and Hold-Open.
- J. Power Switch: Automatic door operators shall be equipped with a two position On/Off switch to control power to the door.

2.6 ACTIVATION DEVICES

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- A. Push Plates: Provide 4 ½ inch (114 mm) square push plates with UL recognized SPDT switch. Face plates and mounting studs shall be stainless steel. Face plates shall be engraved with the international symbol for accessibility and "Push To Open". Push plates shall be wall mounted in single or double gang electrical boxes and hardwired to door operator controls.

2.7 ALUMINUM FINISHES

- A. General: Comply with NAAMM Metal Finishes Manual for Architectural and Metal Products for recommendations for applying and designing finishes. Finish designations prefixed by AA comply with system established by Aluminum Association for designing finishes.
- B. Class I, Clear Anodic Finish: AA-M12C22A41 Mechanical Finish: as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.70 mils minimum complying with AAMA 611-98 and the following:
 1. AAMA 607.1
 2. Applicator must be fully compliant with all applicable environmental regulations and permits, including wastewater and heavy metal discharge.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of swinging automatic entrance doors. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Do not install damaged components. Fit joints to produce hairline joints free of burrs and distortion. Rigidly secure non-movement joints.
- B. Mounting: Install automatic door operators/headers plumb and true in alignment with established lines and grades. Anchor securely in place.
 1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
 2. Set headers, arms and linkages level and true to location with anchorage for permanent support.
- C. Door Operators: Connect door operators to electrical power distribution system as specified in Division 16 Sections.
- D. Sealants: Comply with requirements specified in Division 7 Section "Joint Sealants" to provide weather tight installation.

3.3 FIELD QUALITY CONTROL

- A. Testing Services: Factory Trained Installer shall test and inspect each swinging automatic entrance door to determine compliance of installed systems with applicable ANSI standards.

3.4 ADJUSTING

- A. Adjust door operators, controls, and hardware for smooth and safe operation, for weather-tight closure, and complying with requirements in ANSI/BHMA A156.19 by AAADM Certified

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Technician.

3.5 CLEANING AND PROTECTION

- A. Clean surfaces promptly after installation. Remove excess sealant compounds, dirt, and other substances. Repair damaged finish to match original finish.

END OF SECTION 087160

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SECTION 088000 - GLASS AND GLAZING

PART 1 - GENERAL

1..1 RELATED DOCUMENTS:

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

1..2 SUMMARY:

- A. Extent of glass and glazing work is indicated on drawings and schedules.
- B. Types of work in this section include glass and glazing for:
 - 1. Window units, not indicated as "pre-glazed".
 - 2. Storefront construction.
 - 3. Entrances and other doors, not indicated as "pre-glazed".
- C. Mirror glass in toilet rooms is specified in a Division-10 section.

1..3 SYSTEM DESCRIPTION:

- A. Provide glass and glazing that has been produced, fabricated and installed to withstand normal thermal movement, wind loading and impact loading (where applicable), without failure including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glass and glazing materials and other defects in the work.
 - 1. Normal thermal movement is defined as that resulting from an ambient temperature range of 120 deg. F (67 deg. C) and from a consequent temperature range within glass and glass framing members of 180 deg. F (100 deg. C).
 - 2. Deterioration of insulating glass is defined as failure of hermetic seal due to other causes than breakage which results in intrusion of dirt or moisture, internal condensation or fogging, deterioration of protected internal glass coating, if any, resulting from seal failure, and any other visual evidence of seal failure or performance.
 - 3. Deterioration of coated glass is defined as the development of manufacturing defects including peeling, cracking or other indications of deterioration in metallic coating due to normal conditions of use.

1..4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical data for each glazing material and fabricated glass product required, including installation and maintenance instructions.
- B. Samples: Submit, for verification purposes, 12" square samples of each type of glass indicated except for clear single pane units, and 12" long samples of each color required (except black) for each type of sealant or gasket exposed to view. Install sealant or gasket sample between two strips of material representative of adjoining framing system in color.
- C. Certificate: Submit certificates from respective manufacturers attesting that glass and glazing materials furnished for project comply with requirements.
 - 1. Separate certification will not be required for glazing materials bearing manufacturer's

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permanent labels designating type and thickness of glass, provided labels represent a quality control program involving a recognized certification agency or independent testing laboratory acceptable to authorities having jurisdiction.

- D. Compatibility and Adhesion Test Report: Submit statement from sealant manufacturer indicating that glass and glazing materials have been tested for compatibility and adhesion with glazing sealants and interpreting test results relative to material performance, including recommendations for primers and substrate preparation needed to obtain adhesion.

1.5 QUALITY ASSURANCE:

- A. Glazing Standards: Comply with recommendations of Flat Glass Marketing Association (FGMA) "Glazing Manual" and "Sealant Manual" except where more stringent requirements are indicated. Refer to those publications for definitions of glass and glazing terms not otherwise defined in this section or other referenced standards.
- B. Safety Glazing Standard: Where safety glass is indicated or required by authorities having jurisdiction, provide type of products indicated which comply with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for category II materials.
 - 1. Subject to compliance with requirements, provide safety glass permanently marked with certification label of Safety Glazing Certification Council (SGCC) or other certification agency acceptable to authorities having jurisdiction.
- C. Insulating Glass Certification Program: Provide insulating glass units permanently marked either on spacers or at least one component pane of units with appropriate certification label of inspecting and testing organization indicated below:
 - 1. Insulating Glass Certification Council (IGCC).
 - 2. Associated Laboratories, Inc. (ALI).
- D. Single Source Responsibility for Glass: To ensure consistent quality of appearance and performance, provide materials produced by a single manufacturer or fabricator for each kind and condition of glass indicated and composed of primary glass obtained from a single source for each type and class required.

1.6 DELIVERY, STORAGE, AND HANDLING:

- A. Protect glass and glazing materials during delivery, storage and handling to comply with manufacturer's directions and as required to prevent edge damage to glass, and damage to glass and glazing materials from effects of moisture including condensation, of temperature changes, of direct exposure to sun, and from other causes.
 - 1. Where insulating glass units will be exposed to substantial altitude changes, avoid hermetic seal ruptures by complying with insulating glass fabricator's recommendations for venting and sealing.

1.7 PROJECT CONDITIONS:

- A. Environmental Conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing material manufacturer or when joint substrates are wet due to rain, frost, condensation or other causes.
 - 1. Install liquid sealants at ambient and substrate temperatures above 40 deg. F (4.4 deg. C).

1.8 WARRANTY:

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- A. General: Warranties shall be in addition to, and not a limitation of, other rights the Owner may have under the Contract Documents.
- B. Manufacturer's Special Project Warranty on Insulating Glass: Provide written warranty signed by manufacturer of insulating glass agreeing to furnish f.o.b. point of manufacture, freight allowed project site, within specified warranty period indicated below, replacements for those insulating glass units developing manufacturing defects. Manufacturing defects are defined as failure or hermetic seal of air space (beyond that due to glass breakage) as evidenced by intrusion of dirt or moisture, internal condensation or fogging, deterioration of protected internal glass coatings, if any, and other visual indications of seal failure or performance; provided the manufacturer's instructions for handling, installing, protecting and maintaining units have been complied with during the warranty period.
 - 1. Warranty Period: Manufacturer's standard but not less than 10 years after date of substantial completion.

PART 2 - PRODUCTS

2..1 MANUFACTURERS:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include; but are not limited to, the following:
 - 1. Manufacturers of Clear Glass:
 - a. AFG Industries, Inc.
 - b. Guardian Industries Corp.
 - c. PPG Industries, Inc.
 - 2. Manufacturers of Insulating Glass:
 - a. AFG Industries, Inc.
 - b. Guardian Industries Corp.
 - c. PPG Industries, Inc.

2..2 GLASS PRODUCTS, GENERAL:

- A. Primary Glass Standard: Provide primary glass which complies with ASTM C 1036 requirements, including those indicated by reference to type, class, quality, and, if applicable, form, finish, mesh and pattern.
- B. Heat-Treated Glass Standard: Provide heat-treated glass which complies with ASTM C 1048 requirements, including those indicated by reference to kind, condition, type, quality, class, and, if applicable, form, finish, and pattern.
- C. Sizes: Fabricate glass to sizes required for glazing openings indicated, with edge clearances and tolerances complying with recommendations of glass manufacturer. Provide thicknesses indicated or, if not otherwise indicated, as recommended by glass manufacturer for application indicated.

2..3 PRIMARY GLASS PRODUCTS:

- A. PPG Solarban 70XL (2) Clear + Clear Glass Insulating Glass Unit or similar. Vfy color w/ Architect.

2..4 HEAT-TREATED GLASS PRODUCTS:

GLASS & GLAZING

- A. Manufacturing Process: Manufacture heat-treated glass as follows:
 - 1. By horizontal (roller hearth) process with roll wave distortion parallel with bottom edge of glass as installed, unless otherwise indicated.
 - 2. By vertical (tong-held) or horizontal (roller hearth) process, at manufacturer's option, except provide horizontal process where indicated as "tongless" or "free of tong marks".
- B. Uncoated Clear Heat-Treated Float Glass: Condition A (uncoated surfaces), Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), kind as indicated below.
 - 1. Kind FT (fully tempered) where indicated.

2..5 SEALED INSULATING GLASS UNITS:

- A. General: Provide preassembled units consisting of organically sealed panes of glass enclosing a hermetically sealed dehydrated air space and complying with ASTM E 774 for performance classification indicated as well as with other requirements specified for glass characteristics, air space, sealing system, sealant, spacer material, corner design and desiccant.
 - 1. For properties of individual glass panes making up units, refer to product requirements specified elsewhere in this section applicable to types, classes, kinds and conditions of glass products indicated.
 - 2. Provide heat-treated panes of kind and at locations indicated or, if not indicated, provide heat-strengthened panes where recommended by manufacturer for application indicated and tempered where indicated or where safety glass is designated or required.
 - 3. Performance characteristics designated for coated insulating glass are nominal values based on manufacturer's published test data for units with 1/4" thick panes of glass and 1/2" thick air space.
 - a. U-values indicated are expressed in the number of Btu's per hour per sq. ft. per degree F difference.
 - 4. Performance Classification per ASTM E 774: Class A.
 - a. Thickness of Each Pane: 1/4".
 - b. Air Space Thickness: 1/2".
 - c. Sealing System: Manufacturer's standard.
 - d. Spacer Material: Manufacturer's standard metal.
 - 5. Desiccant: Manufacturer's standard; either molecular sieve or silica gel or blend of both.
 - 6. Corner Construction: Manufacturer's standard corner construction.
- B. Uncoated Glass: Manufacturer's standard units complying with the following requirements: (Interior Glazing Only).
 - 1. Exterior Pane: Clear float glass. Unless tempered required by code due to proximity to door openings or distance to floor.
- C. Coated, Insulating Glass Units:
 - 1. Similar in performance characteristics to PPG-Solarban Acuity Tinted Low 'E' Glass. Final color to be approved by architect prior to placing order for glass.

2..6 ELASTOMERIC GLAZING SEALANTS AND PREFORMED GLAZING TAPES:

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- A. General: Provide products of type indicated and complying with the following requirements:
1. Compatibility: Select glazing sealants and tapes of proven compatibility with other materials with which they will come into contact, including glass products, seals of insulating glass units, and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.
 2. Suitability: Comply with recommendations of sealant and glass manufacturers for selection of glazing sealants and tapes which have performance characteristics suitable for applications indicated and conditions at time of installation.
 3. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated which complies with ASTM C 920 requirements, including those for Type, Grade, Class and Uses.
 4. Colors: Provide color of exposed sealants indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors.
- B. Preformed Butyl-Polyisobutylene Glazing Tape: Provide manufacturer's standard solvent-free butyl-polyisobutylene formulation with a solids content of 100 percent; complying with AAMA A 804.1; in extruded tape form; non-staining and non-migrating in contact with nonporous surfaces; packaged on rolls with a release paper on one side; with or without continuous spacer rod as recommended by manufacturers of tape and glass for application indicated.
- C. Available Products: Subject to compliance with requirements, glazing sealants which may be incorporated in the work include, but are not limited to, the following:
1. Preformed Butyl-Polyisobutylene Glazing Tape Without Spacer Rod:
 - a. "Chem-Tape 40"; Bostik Construction Products Div.
 - b. "Extru-Seal"; Pecora Corp.
 - c. "PTI 303" Glazing Tape; Protective Treatments, Inc.
 - d. "Tremco 440 Tape"; Tremco Inc.

2..7 GLAZING GASKETS:

- A. Dense Elastomeric Compression Seal Gaskets: Molded or extruded gaskets of material indicated below, complying with ASTM C 864, of profile and hardness required to maintain watertight seal:
1. Neoprene.
 2. EPDM.
 3. Thermoplastic polyolefin rubber.
 4. Any material indicated above.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
1. Manufacturers of Preformed Gaskets:
 - a. D. S. Brown Co.
 - b. Maloney Precision Products Co.
 - c. Tremco.

2..8 MISCELLANEOUS GLAZING MATERIALS:

- A. Compatibility: Provide materials with proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.

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- C. Setting Blocks: Neoprene, EPDM or silicone blocks as required for compatibility with glazing sealants, 80 to 90 Shore A durometer hardness.
- D. Spacers: Neoprene, EPDM or silicone blocks, or continuous extrusions, as required for compatibility with glazing sealant, of size, shape and hardness recommended by glass and sealant manufacturers for application indicated.
- E. Edge Blocks: Neoprene, EPDM or silicone blocks as required for compatibility with glazing sealant, of size and hardness required to limit lateral movement (side-walking) of glass.
- F. Compressible Filler Rods: Closed-cell or waterproof-jacketed rod stock of synthetic rubber or plastic foam, flexible and resilient, with 5-10 psi compression strength for 25 percent deflection.

PART 3 - EXECUTION

3..1 EXAMINATION:

- A. Require Glazier to inspect work of glass framing erector for compliance with manufacturing and installation tolerances, including those for size, squareness, offsets at corners; for presence and functioning of weep system; for existence of minimum required face or edge clearances; and for effective sealing of joinery. Obtain Glazier's written report listing conditions detrimental to performance of glazing work. Do not allow glazing work to proceed until unsatisfactory conditions have been corrected.

3..2 PREPARATION:

- A. Pre-Installation Meeting: At Contractor's direction, Glazier, sealant and gasket manufacturers' technical representatives, glass framing erector and other trades whose work affects glass and glazing shall meet at project site to review procedures and time schedule proposed for glazing and coordination with other work.
- B. Clean glazing channels and other framing members to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to substrates. Remove lacquer from metal surfaces where elastomeric sealants are indicated for use.

3..3 GLAZING, GENERAL:

- A. Comply with combined printed recommendations of glass manufacturers, of manufacturers of sealants, gaskets and other glazing materials, except where more stringent requirements are indicated, including those of referenced glazing standards.
- B. Glazing channel dimensions as indicated in details are intended to provide for necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by job conditions at time of installation.
- C. Protect glass from edge damage during handling and installation; use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass with flares or bevels along one horizontal edge which would occur in vicinity of setting blocks so that these are located at top of opening. Remove from project and dispose of glass units with edge damage or other imperfections of kind that, when installed, weakens glass and impairs performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

3..4 GLAZING:

- A. Install setting blocks of proper size in sill rabbet, located one quarter of glass width from each corner, but with edge nearest corner not closer than 6" from corner, unless otherwise required. Set blocks in thin course of sealant which is acceptable for heel bead use.
- B. Provide spacers inside and out, of correct size and spacing to preserve required face clearances, for glass sizes larger than 50 united inches (length plus height), except where gaskets or glazing tapes with continuous spacer rods are used for glazing. Provide 1/8" minimum bite of spacers on glass and use thickness equal to sealant width, except with sealant tape use thickness slightly less than final compressed thickness of tape.
- C. Provide edge blocking to comply with requirements of referenced glazing standard, except where otherwise required by glass unit manufacturer.
- D. Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.
- E. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage to ensure that gasket will not "walk" out when installation is subjected to movement.
- F. Miter cut wedge-shaped gaskets at corners and install gaskets in manner recommended by gasket manufacturer to prevent pull away at corners; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.5 PROTECTION AND CLEANING:

- A. Protect exterior glass from breakage immediately upon installation by use of crossed streamers attached to framing and held away from glass. Do not apply markers to surfaces of glass. Remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove immediately by method recommended by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less often than once a month, for build-up of dirt, scum, alkali deposits or staining. When examination reveals presence of these forms of residue, remove by method recommended by glass manufacturer.
- D. Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during construction period, including natural causes, accidents and vandalism.
- E. Wash glass on both faces not more than 4 days prior to date scheduled for inspections intended to establish date of substantial completion in each area of project. Wash glass by method recommended by glass manufacturer.

END OF SECTION 088000

SECTION 092600 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:

- 1. Interior gypsum wallboard.
- 2. Exterior gypsum board panels for ceilings and soffits.
- 3. Tile backing panels.
- 4. Non-load-bearing steel framing.

- B. Related Sections include the following:

- 1. Division 5 Section "**Cold-Formed Metal Framing**" for load-bearing steel framing.
- 2. Division 6 Section "**Rough Carpentry**" for wood framing and furring
- 3. Division 7 Section "**Building Insulation**" for insulation and vapor retarders installed in gypsum board assemblies.
- 4. Division 9 Section "**Ceramic Tile**" for cementitious backer units installed as substrates for ceramic tile.

1.3 DEFINITIONS

- A. Gypsum Board Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show locations, fabrication, and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other units of Work.
- C. Samples: For the following products:
 - 1. Trim Accessories: Full-size sample in **12-inch- (300-mm-)** long length for each trim accessory indicated.

1.5 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to

ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance-Rated Assemblies: Indicated by design designations from **UL's "Fire Resistance Directory", GA-600, "Fire Resistance Design Manual" or in the listing of another testing and inspection agency acceptable to authorities having jurisdiction.**
- B. Sound Transmission Characteristics: For gypsum board assemblies with STC ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.
 1. STC-Rated Assemblies: Indicated by design designations from **GA-600, "Fire Resistance Design Manual" or in the listing of another testing and inspection agency acceptable to authorities having jurisdiction.**
- C. Gypsum Board Finish Mockups: Before finishing gypsum board assemblies, install mockups of at least **100 sq. ft. (9 sq. m)** in surface area to demonstrate aesthetic effects and qualities of materials and execution.
 1. Install mockups for the following applications:
 - a. Surfaces with texture finishes.
 - b. Surfaces indicated to receive nontextured paint finishes.
 - c. Surfaces indicated to receive textured paint finishes.
 2. Simulate finished lighting conditions for review of mockups.
 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- D. Single source responsibility for panel products: Obtain each type of gypsum bd. and other panel products from a single manufacturer.
- E. Single source responsibility for steel framing: Obtain steel framing members for gypsum board assemblies from a single manufacturer, unless otherwise indicated.
- F. Single source responsibility for finish materials: Obtain finishing materials from either the same manufacturer that supplies the gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products **by one** of the following:
 - 1. Steel Framing and Furring:
 - a. Clark Steel Framing Systems.
 - b. Consolidated Systems, Inc.
 - c. Dale Industries, Inc. - Dale/Incor.
 - d. Dietrich Industries, Inc.
 - e. MarinoWare; Division of Ware Ind.
 - f. National Gypsum Company.
 - g. Scafco Corporation.
 - h. Unimast, Inc.
 - i. Western Metal Lath & Steel Framing Systems.
 - 2. Gypsum Board and Related Products:
 - a. American Gypsum Co.
 - b. G-P Gypsum Corp.
 - c. National Gypsum Company.
 - d. United States Gypsum Co.

2.2 STEEL SUSPENDED CEILING AND SOFFIT FRAMING

- A. Components, General: Comply with ASTM C 754 for conditions indicated.
- B. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.
- C. Hanger Attachments to Concrete: As follows:
 - 1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching hanger wires and capable of sustaining, without failure, a load equal to **5** times that imposed by construction as determined by testing according to ASTM E 488 by a qualified independent testing agency.
 - a. Type: **Cast-in-place anchor, designed for attachment to concrete forms or Postinstalled, expansion anchor.**
 - 2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to **10** times that imposed by construction as determined by testing according to ASTM E 1190 by a qualified independent testing agency.
- D. Hangers: As follows:

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1. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch (4.12-mm) diameter.
 2. Rod Hangers: ASTM A 510 (ASTM A 510M), mild carbon steel.
 - a. Diameter: **As indicated**
 - b. Protective Coating: **ASTM A 153/A 153M, hot-dip galvanized.**
 3. Flat Hangers: Commercial-steel sheet, **ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized.**
 - a. Size: **As indicated**
 4. Angle Hangers: ASTM A 653/A 653M, [G90 (Z180)], hot-dip galvanized commercial-steel sheet.
 - a. Minimum Base Metal Thickness: [As indicated] [0.0179 inch (0.45 mm)] [0.0312 inch (0.79 mm)] <Insert thickness>.
 - b. Size: 7/8 by 1-3/8 inches (22.2 by 34.9 mm) min. .
- E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base metal thickness of 0.0538 inch (1.37 mm), a minimum 1/2-inch- (12.7-mm-) wide flange, with **ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized** zinc coating.
1. Depth: 1-1/2 inches (38.1 mm) min.
- F. Furring Channels (Furring Members): Commercial-steel sheet with **ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized** zinc coating.
1. Cold Rolled Channels: 0.0538-inch (1.37-mm) bare steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flange, 3/4 inch (19.1 mm) deep.
 2. Steel Studs: ASTM C 645.
 - a. Minimum Base Metal Thickness: **As indicated**
 - b. Depth: **As indicated.**
 3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22.2 mm) deep.
 - a. Minimum Base Metal Thickness: **As indicated.**
 4. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep members designed to reduce sound transmission.
 - a. Configuration: **Asymmetrical or hat shaped, with face attached to single flange by a slotted leg (web) or attached to two flanges by slotted or expanded metal legs.**
- G. Grid Suspension System for Interior Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide [one of] the following:
 - a. Armstrong World Industries, Inc.; Furring Systems/Drywall.
 - b. Chicago Metallic Corporation;
 - c. USG Interiors, Inc.; Drywall Suspension System.

2.3 STEEL PARTITION AND SOFFIT FRAMING

- A. Components, General: As follows:
 - 1. Comply with ASTM C 754 for conditions indicated.
 - 2. Steel Sheet Components: Complying with ASTM C 645 requirements for metal and with, **G60 (Z180)**, zinc coating.
- B. Steel Studs and Runners: ASTM C 645.
 - 1. Minimum Base Metal Thickness: 20 gauge at all locations unless called out to be installed as structural stud or cold rolled steel framing.
 - 2. Depth: **As indicated** .
- C. Deep-Leg Deflection Track: ASTM C 645 top runner with **2-inch- (50.8-mm-)** deep flanges.
- D. Proprietary Deflection Track: Steel sheet top runner manufactured to prevent cracking of gypsum board applied to interior partitions resulting from deflection of structure above; in thickness indicated for studs and in width to accommodate depth of studs.
 - 1. Available Product: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
- E. Proprietary Firestop Track: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - 1. Available Product: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
- F. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 - 1. Minimum Base Metal Thickness: **.0598-inch**.
- G. Cold-Rolled Channel Bridging: **0.0538-inch (1.37-mm)** bare steel thickness, with minimum **1/2-inch- (12.7-mm-)** wide flange.
 - 1. Depth: **As indicated**.
 - 2. Clip Angle: **1-1/2 by 1-1/2 inch (38.1 by 38.1 mm)**, **0.068-inch- (1.73-mm-)** thick, galvanized steel.
- H. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 - 1. Minimum Base Metal Thickness: **0.0312 inch (0.79 mm)**.
 - 2. Depth: **As indicated**.
- I. Resilient Furring Channels: **1/2-inch- (12.7-mm-)** deep, steel sheet members designed to reduce sound transmission.
 - 1. Configuration: **Asymmetrical or hat shaped, with face attached to single flange by a slotted leg (web) or attached to two flanges by slotted or expanded metal legs**.
- J. Cold-Rolled Furring Channels: **0.0538-inch (1.37-mm)** bare steel thickness, with minimum **1/2-inch- (12.7-mm-)** wide flange.

1. Depth: **As indicated.**
 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare steel thickness of **0.0312 inch (0.79 mm).**
 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, **0.0625-inch- (1.59-mm-)** diameter wire, or double strand of **0.0475-inch- (1.21-mm-)** diameter wire.
- K. Z-Shaped Furring: With slotted or nonslotted web, face flange of **1-1/4 inches (31.8 mm)**, wall attachment flange of **7/8 inch (22.2 mm)**, minimum bare metal thickness of **0.0179 inch (0.45 mm)**, and depth required to fit insulation thickness indicated.
- L. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

2.4 INTERIOR GYPSUM WALLBOARD

- A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.
- B. Gypsum Wallboard: ASTM C 36.
1. Regular Type:
 - a. Thickness: **As indicated.**
 - b. Long Edges: **Tapered.**
 - c. Location: **As indicated.**
 2. Type X:
 - a. Thickness: **5/8 inch (15.9 mm).**
 - b. Long Edges: **Tapered.**
 - c. Location: **As indicated.**
- C. Flexible Gypsum Wallboard: ASTM C 36, manufactured to bend to fit tight radii and to be more flexible than standard regular-type panels of the same thickness.
1. Thickness: **1/4 inch (6.4 mm).**
 2. Long Edges: **Tapered.**
 3. Location: **Apply in double layer at curved assemblies.**
- D. Sag-Resistant Gypsum Wallboard: ASTM C 36, manufactured to have more sag resistance than regular-type gypsum board.
1. Thickness: **1/2 inch (12.7 mm).**
 2. Long Edges: **Tapered.**
 3. Location: **As indicated.**
- E. Proprietary, Special Fire-Resistive Type: ASTM C 36, having improved fire resistance over standard Type X.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide **one of** the following:
 - a. American Gypsum Co.; FireBloc Type C.
 - b. G-P Gypsum Corp.; Firestop Type C.
 - c. National Gypsum Company; Gold Bond Fire-Shield G.

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- d. United States Gypsum Co.; SHEETROCK Brand Gypsum Panels, **FIRECODE C Core ULTRACODE Core.**

3. Thickness: **As indicated.**
4. Long Edges: **Tapered .**
5. Location: **As indicated.**

2.5 EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS

- A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.
- B. Exterior Gypsum Soffit Board: ASTM C 931/C 931M, with manufacturer's standard edges.
 1. Core: **As indicated.**
- C. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M.
 1. Available Product: Subject to compliance with requirements, a product that may be incorporated into the Work includes, but is not limited to, "Dens-Glass Gold" by G-P Gypsum Corp.
 2. Product: Subject to compliance with requirements, provide "Dens-Glass Gold" by G-P Gypsum Corp.
 3. Core: **As indicated.**

2.6 TILE BACKING PANELS

- A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.
- B. Water-Resistant Gypsum Backing Board: ASTM C 630/C 630M.
 1. Core: **As indicated.**
- C. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M.
 1. Available Product: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, "Dens-Shield Tile Backer" manufactured by G-P Gypsum Corp.
 2. Product: Subject to compliance with requirements, provide "Dens-Shield Tile Backer" manufactured by G-P Gypsum Corp.
 3. Core: **As indicated.**
- D. Cementitious Backer Units: ANSI A118.9.
 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide [**one of**] the following:
 - a. Custom Building Products; Wonderboard.
 - b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
 - c. United States Gypsum Co.; DUROCK Cement Board.
 3. Thickness: **As indicated >.**

2.7 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: **Galvanized or aluminum-coated steel sheet or rolled zinc or plastic.**
2. Shapes:
 - a. Cornerbead: Use at outside corners[, **unless otherwise indicated**].
 - b. Bullnose Bead: **Use at outside corners Use where indicated.**
 - c. LC-Bead (J-Bead): Use at exposed panel edges.
 - d. L-Bead: **Use where indicated.**
 - e. U-Bead: **Use where indicated.**
 - f. Expansion (Control) Joint: **Use where indicated.**
 - g. Curved-Edge Cornerbead: With notched or flexible flanges; use at curved openings.

B. Exterior Trim: ASTM C 1047.

1. Material: Hot-dip galvanized steel sheet or rolled zinc.
2. Shapes:
 - a. Cornerbead: Use at outside corners.
 - b. LC-Bead (J-Bead): Use at exposed panel edges.
 - c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening. **Use where indicated.**

C. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by **[one of]** the following:
 - a. Fry Reglet Corp.
 - b. Gordon, Inc.
 - c. MM Systems Corporation.
 - d. Pittcon Industries.
3. Aluminum: Alloy and temper with not less than the strength and durability properties of [ASTM B 221 \(ASTM B 221M\)](#), alloy 6063-T5.
4. Finish: **Corrosion-resistant primer compatible with joint compound and finish materials specified.** >.

2.8 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.
2. Exterior Gypsum Soffit Board: Paper.
3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
4. Tile Backing Panels: As recommended by panel manufacturer.

- C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
1. Prefilling: At open joints, **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 **drying-type, all-purpose compound**.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 3. Fill Coat: For second coat, use **drying-type, all-purpose compound**.
 4. Finish Coat: For third coat, use **setting-type, sandable topping compound**.
 5. Skim Coat: For final coat of Level 5 finish, use **setting-type, sandable topping compound**.
- D. Joint Compound for Exterior Applications:
1. Exterior Gypsum Soffit Board: Use setting-type taping and setting-type, sandable topping compounds.
 2. Glass-Mat Gypsum Sheathing Board: As recommended by manufacturer.
- E. Joint Compound for Tile Backing Panels:
1. Water-Resistant Gypsum Backing Board: Use setting-type taping and setting-type, sandable topping compounds.
 2. Glass-Mat, Water-Resistant Backing Panel: As recommended by manufacturer.
 3. Cementitious Backer Units: As recommended by manufacturer.

2.9 ACOUSTICAL SEALANT

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
- B. Products: Subject to compliance with requirements, provide **[one of]** the following:
1. Acoustical Sealant for Exposed and Concealed Joints:
 - a. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
 - b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
 2. Acoustical Sealant for Concealed Joints:
 - a. Ohio Sealants, Inc.; Pro-Series SC-170 Rubber Base Sound Sealant.
 - b. Pecora Corp.; BA-98.
 - c. Tremco, Inc.; Tremco Acoustical Sealant.
- C. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining, latex sealant complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
- D. Acoustical Sealant for Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

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2.10 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 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.
- D. Isolation Strip at Exterior Walls:
 - 1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
 - 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.
- E. Sound Attenuation Blankets: ASTM C 665, 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.
- F. Thermal Insulation: As specified in Division 7 Section "Building Insulation."
- G. Polyethylene Vapor Retarder: As specified in Division 7 Section "Building Insulation."

2.11 TEXTURE FINISHES

- A. Wall finish is **not** to have a textured finish. A smooth finish (grade 5) will be maintained.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Ceilings: Coordinate installation of ceiling suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers at spacing required to support ceilings and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed-on fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches (600 mm) o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of gypsum board assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

3.3 INSTALLING STEEL FRAMING, GENERAL

- A. Installation Standards: ASTM C 754, and ASTM C 840 requirements that apply to framing installation.
- B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with gypsum board manufacturer's written recommendations or, if none available, with United States Gypsum's "Gypsum Construction Handbook."
- C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement.
 1. Isolate ceiling assemblies where they abut or are penetrated by building structure.
 2. Isolate partition framing and wall furring where it abuts structure, except at floor. Install slip-type joints at head of assemblies that avoid axial loading of assembly and laterally support assembly.
 - a. Use deep-leg deflection track where indicated.
 - b. Use proprietary deflection track where indicated.
 - c. Use proprietary firestop track where indicated.
- D. Do not bridge building control and expansion joints with steel framing or furring members. Frame both sides of joints independently.

3.4 INSTALLING STEEL SUSPENDED CEILING AND SOFFIT FRAMING

- A. Suspend ceiling hangers from building structure as follows:
 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
 4. Secure **rod, flat, or angle** hangers to structure, including intermediate framing members, by attaching to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 5. Do not support ceilings directly from permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 6. Do not attach hangers to steel deck tabs.
 7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- B. Installation Tolerances: Install steel framing components for suspended ceilings so members for panel attachment are level to within **1/8 inch in 12 feet (3 mm in 3.6 m)** measured lengthwise on each member and transversely between parallel members.
- C. Sway-brace suspended steel framing **with hangers used for support**.
- D. For exterior soffits, install cross bracing and framing to resist wind uplift.
- E. Screw furring to wood framing.
- F. Wire-tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.
- G. Install suspended steel framing components in sizes and spacings indicated, but not less than that required by the referenced steel framing and installation standards.
1. Hangers: **48 inches (1219 mm)** o.c.
 2. Carrying Channels (Main Runners): **48 inches (1219 mm)** o.c.
 3. Furring Channels (Furring Members): **16 inches (406 mm)** o.c.
- H. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

3.5 INSTALLING STEEL PARTITION AND SOFFIT FRAMING

- A. Install tracks (runners) at floors, ceilings, and structural walls and columns where gypsum board assemblies abut other construction.
1. Where studs are installed directly against exterior walls, install **asphalt-felt or foam-gasket** isolation strip between studs and wall.
- B. Installation Tolerance: Install each steel framing and furring member so fastening surfaces vary not more than **1/8 inch (3 mm)** from the plane formed by the faces of adjacent framing.
- C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
1. Cut studs **1/2 inch (13 mm)** short of full height to provide perimeter relief.
 2. For **fire-resistance-rated and STC-rated** partitions that extend to the underside of floor/ roof slabs and decks or other continuous solid-structure surfaces to obtain ratings, install

framing around structural and other members extending below floor/roof slabs and decks, as needed to support gypsum board closures and to make partitions continuous from floor to underside of solid structure.

- a. Terminate partition framing at suspended ceilings where indicated.
- D. Install steel studs and furring at the following spacings:
1. Single-Layer Construction: 16 inches (406 mm) o.c., unless otherwise indicated.
 2. Multilayer Construction: 16 inches (406 mm) o.c., unless otherwise indicated.
 3. Cementitious Backer Units: 16 inches (406 mm) m] o.c., unless otherwise indicated.
- E. Install steel studs so flanges point in the same direction and leading edge or end of each panel can be attached to open (unsupported) edges of stud flanges first.
- F. Curved Partitions:
1. Cut top and bottom track (runners) through leg and web at 2-inch (50-mm) intervals for arc length. In cutting lengths of track, allow for uncut straight lengths of not less than 12 inches (300 mm) at ends of arcs.
 2. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
 3. Support outside (cut) leg of track by clinching steel sheet strip, 1-inch- (25-mm-) high-by-thickness of track metal, to inside of cut legs using metal lock fasteners.
 4. Begin and end each arc with a stud, and space intermediate studs equally along arcs at stud spacing recommended in writing by gypsum board manufacturer for radii indicated. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches (150 mm) o.c.
- G. Frame door openings to comply with GA-600 and with gypsum board manufacturer's applicable written recommendations, unless otherwise indicated. Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
1. Install two studs at each jamb, unless otherwise indicated.
 2. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint.
 3. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above.
- H. Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
- I. Z-Furring Members:
1. Erect insulation vertically and hold in place with Z-furring members spaced 24 inches (610 mm) o.c.
 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (600 mm) o.c.
 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches (300 mm) from corner and cut insulation to fit.
 4. Until gypsum board is installed, hold insulation in place with 10-inch (250-mm) staples fabricated from 0.0625-inch- (1.59-mm-) diameter, tie wire and inserted through slot in web of member.

- J. Polyethylene Vapor Retarder: Install to comply with requirements specified in Division 7 Section "Building Insulation."

3.6 APPLYING AND FINISHING PANELS, GENERAL

- A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216.
- B. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.
- C. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- D. Install gypsum 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.
- E. 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.
- F. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- G. Attach gypsum panels to framing provided at openings and cutouts.
- H. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members using resilient channels, or provide control joints to counteract wood shrinkage.
- I. Form control and expansion joints with space between edges of adjoining gypsum panels.
- J. Cover both faces of steel stud partition 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 open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow **1/4- to 3/8-inch- (6.4- to 9.5-mm-)** wide joints to install sealant.
- K. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide **1/4- to 1/2-inch- (6.4- to 12.7-mm-)** wide spaces at these locations, and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- L. Floating Construction: Where feasible, including where recommended in writing by manufacturer, install gypsum panels over wood framing, with floating internal corner construction.
- M. STC-Rated Assemblies: Seal construction at perimeters, behind control and expansion 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 C 919 and manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.

- N. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.
 - 1. Space screws a maximum of **12 inches (304.8 mm)** o.c. for vertical applications.
- O. Space fasteners in panels that are tile substrates a maximum of **8 inches (203.2 mm)** o.c.

3.7 PANEL APPLICATION METHODS

- A. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels **horizontally (perpendicular 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 board.
 - b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
 - 3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
- B. Multilayer Application on Ceilings: Apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, **16 inches (400 mm)** minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
- C. Multilayer Application on Partitions/Walls: Apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
 - 1. Z-Furring Members: Apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
- D. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- E. Multilayer Fastening Methods: Fasten base layers and face layers separately to supports with screws.
- F. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

G. Curved Partitions:

1. Install panels horizontally and unbroken, to the extent possible, across curved surface plus 12-inch- (300-mm-) long straight sections at ends of curves and tangent to them.
2. Wet gypsum panels on surfaces that will become compressed where curve radius prevents using dry panels. Comply with gypsum board manufacturer's written recommendations for curve radii, wetting methods, stacking panels after wetting, and other preparations that precede installing wetted gypsum panels.
3. On convex sides of partitions, begin installation at one end of curved surface and fasten gypsum panels to studs as they are wrapped around curve. On concave side, start fastening panels to stud at center of curve and work outward to panel ends. Fasten panels to framing with screws spaced 12 inches (300 mm) o.c.
4. For double-layer construction, fasten base layer to studs with screws 16 inches (400 mm) o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches (300 mm) o.c.
5. Allow wetted gypsum panels to dry before applying joint treatment.

H. Exterior Soffits and Ceilings: Apply exterior gypsum soffit board panels perpendicular to supports, with end joints staggered and located over supports.

1. Install with 1/4-inch (6.4-mm) open space where panels abut other construction or structural penetrations.
2. Fasten with corrosion-resistant screws.

I. Tile Backing Panels:

1. Water-Resistant Gypsum Backing Board: Install at showers, tubs, and where indicated. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
2. Glass-Mat, Water-Resistant Backing Panel: Comply with manufacturer's written installation instructions and install at **locations indicated on drawings**. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
3. Cementitious Backer Units: ANSI A108.11, at **locations indicated on drawings**.
4. Areas Not Subject to Wetting: Install standard gypsum wallboard panels to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.
5. Where tile backing panels abut other types of panels in the same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.8 INSTALLING 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] [Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect].

3.9 FINISHING GYPSUM BOARD ASSEMBLIES

- 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 **or beveled edges**, and damaged surface areas.

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- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:
 - 1. Level 1: Embed tape at joints in ceiling plenum areas, concealed areas, and where indicated[, **unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies (concealed spaces).**
 - 2. Level 5: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges **at panel surfaces that will be exposed to view, unless otherwise indicated.**
- E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
- F. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.
- G. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.10 APPLYING 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 **matching approved mockup and** 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 recommendations.

3.11 FIELD QUALITY CONTROL

- A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, Architect will conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.
 - 1. Notify Architect **seven** days in advance of date and time when Project, or part of Project, will be ready for above-ceiling observation.
 - 2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:
 - a. Installation of **80** percent of lighting fixtures, powered for operation.
 - b. Installation, insulation, and leak and pressure testing of water piping systems.
 - c. Installation of air-duct systems.
 - d. Installation of air devices.
 - e. Installation of mechanical system control-air tubing.
 - f. Installation of ceiling support framing.

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3.12 CLEANING AND PROTECTION

- A. Promptly remove any residual joint compound from adjacent surfaces.
- B. Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure gypsum board assemblies are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 092600

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SECTION 093000 - TILE

PART 1 – GENERAL

1..1 RELATED DOCUMENTS

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

1..2 SUMMARY

- A. This Section includes the following:
 - 1. Glazed Floor tile.
 - 2. Glazed wall tile.
 - 3. Stone thresholds.
- B. Related Sections: The following sections contain requirements that relate to this Section:
 - 1. Division 3 Section "Concrete Work" for monolithic slab finishes specified for tile substrates.

1..3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data for each type of product specified.
- C. Samples for verification purposes of each item listed below, prepared on samples of size and construction indicated, products involve color and texture variations, in sets showing full range of variations expected.
 - 1. Each type and composition of tile and for each color and texture required, at least 12 inches square, mounted on plywood or hardboard backing and grouted.
 - 2. Full-size units of each type of trim and accessory for each color required.
 - 3. Stone thresholds in 6-inch lengths.
- D. Master grade certificates for each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

1..4 QUALITY ASSURANCE

- A. Single-Source Responsibility for Tile: Obtain each color, grade, finish, type, composition, and variety of tile from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.
- B. Single-Source Responsibility for Setting and Grouting Materials: Obtain ingredients of a uniform quality from one manufacturer for each cementitious and admixture component and from one source or producer for each aggregate.
- C. Installer Qualifications: Engage an experienced Installer who has successfully completed tile installations similar in material, design, and extent to that indicated for Project.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings".

1..5 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 requirement of ANSI A137.1 for labeling sealed tile packages.
- B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.
- C. Handle tile with temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If despite these precautions coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1..6 PROJECT CONDITIONS

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- A. Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations.
- B. Vent temporary heaters to exterior to prevent damage to tile work from carbon dioxide buildup.
- C. Maintain temperatures at 50 deg F (10 deg C) or more in tiled areas during installation and for 7 days after completion, unless higher temperatures are required by referenced installation standard or manufacturer's instructions.

1..7 EXTRA MATERIALS

- A. Deliver extra materials to Owner. Furnish extra materials that match products installed as described below, packaged with protective covering for storage and identified with labels clearly 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.

PART 2 – PRODUCTS

2..1 PRODUCTS, GENERAL

- A. ANSI Standard for Ceramic Tile: Comply with ANSI A137.1 "American National Standard Specifications for Ceramic Tile" for types, compositions, and grades of tile indicated.
 - 1. Furnish tile complying with "Standard Grade" requirements unless otherwise indicated.
- B. ANSI Standard for Tile Installation Materials: Comply with ANSI standard referenced with products and materials indicated for setting and grouting.
- 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. Match Architect's sample.
- D. Factory Blending: For tile exhibiting color variations within the ranges selected during sample submittals, blend tile in factory and package accordingly so that tile units taken from one package show the same range in colors as those taken from other packages and match approved samples.
- E. Mounting: Where factory-mounted tile is required, provide back- or edge-mounted tile assemblies as standard with manufacturer unless another mounting method is indicated.
 - 1. Where tile is indicated for installation in swimming pools, on exteriors or in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies that this type of mounting is suitable for these kinds of uses and has been successfully used on other projects.
- F. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating them with a continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2..2 TILE PRODUCTS

REFER TO LIST IN PROJECT MANUAL FOR TILE STYLES AND COLORS. IF NOT LISTED, OWNER SHALL SELECT TILE(S) FROM LISTED MANUFACTURES FULL LINE OF COLORS AND STYLES .

- A. Ceramic or Porcelain Floor Tile (Lobby Area): Provide flat tile complying with the following requirements:
REFER TO FINISH LIST IN PROJECT MANUAL FOR COLOR AND STYLE
- B. Ceramic Floor Tile (Restroom): Provide factory-mounted flat tile complying with the following requirements:
REFER TO FINISH LIST IN PROJECT MANUAL FOR COLOR AND STYLE

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- C. Glazed Wall Tile (Restroom): Provide flat tile complying with the following requirements:
REFER TO FINISH LIST IN PROJECT MANUAL FOR COLOR AND STYLE

2..3 STONE THRESHOLDS

- A. General: Provide stone that is uniform in color and finish, fabricated to sizes and profiles indicated or required to provide transition between tile surfaces and adjoining finished floor surfaces.
- B. Marble Thresholds: Provide marble thresholds complying with ASTM C 503 requirements for exterior use and for abrasion resistance where exposed to foot traffic, a minimum hardness of 10 per ASTM C 241.
 - 1. Provide black, honed marble complying with MIA Group "A" requirements for soundness.
- VFY w/ owner if marble threshold is desired or if schluter strip is acceptable.

2..4 SETTING MATERIALS

- A. Portland Cement Mortar Installation Materials: Provide materials complying with ANSI A108.1 and as specified below.
 - 1. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15), or polyethylene sheeting ASTM D 4397, 4.0 mils thick.
 - 2. Reinforcing Wire Fabric: Galvanized welded wire fabric, 2 inches by 2 inches - WO.3 by WO.3 (16 ASW gage or 0.0625 inch diameter); comply with ASTM A 185 and ASTM A 82 except for minimum wire size.
 - 3. Expanded Metal Lath: Provide diamond mesh lath complying with ASTM C 847 for requirements indicated below:
 - A. Base Metal and Finish for Interior Applications: Fabricate lath from uncoated or zinc-coated (galvanized) steel sheet, with uncoated steel sheet painted after fabrication into lath.
 - B. Weight: 3.4 psf.
 - 4. Latex additive (water emulsion) described below, serving as replacement for part or all of gauging water, of type specifically recommended by latex additive manufacturer for use with job-mixed portland cement and aggregate mortar bed.
 - A. Latex Additive: Manufacturer's standard.
- B. Latex-Portland Cement Mortar: ANSI A118.4, composition as follows:
 - 1. Prepackaged dry mortar mix composed of portland cement, graded aggregate, and the following dry polymer additive in the form of a reemulsifiable powder to which only water is added at job site.
 - A. Dry Polymer Additive: Manufacturer's standard.
 - 2. Latex additive (water emulsion) of type described below, serving as replacement for part or all of gauging water, combined at job site with prepackaged dry mortar mix supplied or specified by latex additive manufacturer.
 - A. Latex Type: Manufacturer's standard.

2..5 GROUTING MATERIALS

- A. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.
- B. Latex-Portland Cement Grout: ANSI A118.6, color as indicated, composition as follows:
 - 1. Prepackaged dry grout mix composed of portland cement, graded aggregate, and the following dry polymer additive in the form of a reemulsifiable powder to which only water is added at job site.
 - A. Dry Polymer Additive: Polyvinyl acetate or ethylene vinyl acetate.

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2. Latex additive (water emulsion) serving as replacement for part or all of gauging water, added at job site with dry grout mixture, with type of latex and dry grout mix as follows:
 - A. Latex Type: Manufacturer's standard.
 - B. Dry Grout Mixture: Commercial portland cement specified or supplied by latex additive manufacturer.
 - 1) Application: Use commercial portland cement grout combined with latex additive for grouting joints in floor tile unless otherwise indicated.

2.6 MISCELLANEOUS MATERIALS

- A. Temporary Protective Coating: Provide product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout, is compatible with tile and mortar/grout products, and is easily removable after grouting is completed without damaging grout or tile.
 1. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as a temporary protective coating for tile.

2.7 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with requirements of referenced standards and manufacturers including those for accurate proportioning of materials, water, or additive content; type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortars and grouts of uniform quality with optimum performance characteristics for application indicated.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine substrates and areas where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 1. Verify that substrates for setting tile are firm, dry, clean, and free from oil or waxy films and curing compounds.
 2. 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 before installing tile.
- B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Blending: For tile exhibiting color variations within the ranges selected during sample submittals, verify that tile has been blended in factory and packaged accordingly so that tile units taken from one package show the same range in 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.
- B. Field-Applied Temporary Protective Coating: Where indicated under tile type or needed to prevent adhesion or staining of exposed tile surfaces by grout, protect exposed surfaces of tile against adherence of mortar and grout by precoating them with a continuous film of temporary protective coating indicated below, taking care not to coat unexposed tile surfaces:
 1. Grout release.
 2. Petroleum paraffin wax or grout release.

3.3 INSTALLATION, GENERAL

- A. ANSI Tile Installation Standard: Comply with parts of ANSI 108 series of tile installation standards included under "American National Standard Specifications for the Installation of Ceramic Tile" that apply to type of setting and grouting materials and methods indicated.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions except as otherwise shown. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. 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 that plates, collars, or covers overlap tile.
- D. Jointing Pattern: Unless otherwise shown, lay tile in grid pattern. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths unless otherwise shown.
 - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so that extent of each sheet is not apparent in finished work.
- E. Lay out tile wainscots to next full tile beyond dimensions indicated.
- F. Grout tile to comply with the requirements of the following installation standards:
 - 1. For ceramic tile grouts (sand-portland cement, dry-set, commercial portland cement, and latex-portland cement grouts), comply with ANSI A108.10.

Match slate tiles within each space by selecting tiles to achieve uniformity of color and pattern. reject or relocate tiles that do not match color and pattern of adjacent tiles.

Mix slate tiles to achieve a uniformly random distribution of color shadings and patterns.

3.4 FLOOR INSTALLATION METHODS

- A. Ceramic Mosaic Tile: Install tile to comply with requirements indicated below for setting bed methods, TCA installation methods related to types of sub-floor construction, and grout types:
 - 1. Concrete sub-floor, interior: TCA F112 (bonded)
 - 2. Latex-Portland Cement Mortar: ANSI A108.5.
- B. Stone Thresholds: Install stone thresholds at locations indicated; set in same type of setting bed as abutting field tile unless otherwise indicated.
 - 1. Set thresholds in latex-portland cement mortar for locations where mortar bed would otherwise be exposed above adjacent nontile floor finish.
- C. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

3.5 WALL TILE INSTALLATION METHODS

- A. Install types of tile designated for wall application to comply with requirements indicated below for setting-bed methods, TCA installation methods related to subsurface wall conditions, and grout types:
 - 1. Latex-Portland Cement Mortar: ANSI A108.5.

3.6 CLEANING AND PROTECTION

- A. Cleaning: Upon completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove latex-portland cement grout residue from tile as soon as possible.
 - 2. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's printed instructions, but no sooner than 14 days after installation. Protect

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metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.

3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to brick and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

Cleaner: Stone cleaner specifically formulated for stone types, finishes, and applications indicated, as recommended by stone producer. Do not use cleaning compounds containing acids, caustics, harsh fillers, or abrasives.

Floor Sealer: Colorless, slip- and stain-resistant sealer that does not affect color or physical properties of stone surfaces, as recommended by stone producer for application indicated.

Manufacturers: Subject to compliance with requirements,

Miracle Sealants Company.

- B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.
- C. Provide final protection and maintain conditions in a manner acceptable to manufacturer and installer that ensures that tile is without damage or deterioration at time of Substantial Completion.
 1. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
 2. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION 093000

SECTION 095110 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1..1 RELATED DOCUMENTS

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

1..2 SUMMARY

- A. This Section includes acoustical panel ceilings installed with exposed suspension systems.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 9 Section "Acoustical Tile" for mineral-base acoustical tile ceilings.
 - 2. Division 15 Section for grilles, registers, and diffusers in acoustical ceilings.
 - 3. Division 16 Section for lighting fixtures in acoustical ceilings.

1..3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
 - 1. Product data for each type of product specified.
 - 2. Samples for verification purposes of each type of exposed finish required, prepared on samples of size indicated below and of same thickness and material indicated for final unit of Work. Where finishes involve normal color and texture variations, include sample sets showing full range of variations expected.
 - a. 6-inch-square samples of each acoustical panel type, pattern, and color.
 - b. Set of 12-inch-long samples of exposed suspension system members, including moldings, for each color and system type required.
 - 3. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, and other information specified.
 - 4. Research reports or evaluation reports of the model code organization acceptable to authorities having jurisdiction that show compliance of acoustical ceiling system and components with building code in effect for Project.
 - 5. Product test reports from qualified independent testing laboratory that are based on its testing of current products for compliance of acoustical ceiling systems and components with requirements.

1..4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has successfully completed acoustical ceilings similar in material, design, and extent to those indicated for Project.
- B. Fire-Performance Characteristics: Provide acoustical ceilings that are identical to those tested for the following fire-performance characteristics, per ASTM test method indicated below, by UL

or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.

1. Surface Burning Characteristics: As follows, tested per ASTM E 84 and complying with ASTM E 1264 for Class A products.
 - a. Flame Spread: 25 or less.
 - b. Smoke Developed: 50 or less.
 - C. Single-Source Responsibility for Ceiling Units: Obtain each type of acoustical ceiling unit from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.
 - D. Single-Source Responsibility for Suspension System: Obtain each type of suspension system from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.
 1. Obtain suspension system from same manufacturer that produces acoustical ceiling units.
 - E. Coordination of Work: Coordinate layout and installation of acoustical ceiling units and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system components (if any), and partition system (if any).
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
 - B. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.
 - C. Handle acoustical ceiling units carefully to avoid chipping edges or damaging units in any way.
- 1.6 PROJECT CONDITIONS
- A. Space Enclosure: Do not install interior acoustical ceilings until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.
- 1.7 EXTRA MATERIALS
- A. Deliver extra materials to Owner. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with appropriate labels.
 1. Acoustical Ceiling Units: Furnish quantity of full-size units equal to 2.0 percent of amount installed.

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2. Exposed Suspension System Components: Furnish quantity of each exposed component equal to 2.0 percent of amount installed.

PART 2 - PRODUCTS

2..1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the following:
 1. Mineral Base Panels - Water Felted, with pre-finished and Perforated and Fissured Pattern, Non-Fire-Resistance Rated:
 - a. Armstrong Ultima with Tegular Edge by Armstrong Ceiling Products w/ Armstrong Prelude XL 15/16" suspension system
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 1. Non-Fire-Resistance-Rated Single-Web Steel Suspension Systems:
 - b. Chicago Metallic Corporation.
 - b. National Rolling Mills Inc.
 - c. Donn Corporation.
 - d. Armstrong
 2. Non-Fire-Resistance-Rated Wide-Face Double-Web Steel Suspension Systems:
 - b. Chicago Metallic Corporation.
 - c. National Rolling Mills, Inc.
 - c. Armstrong
 3. Edge Moldings:
 - a. Chicago Metallic Corporation.
 - b. National Rolling Mills, Inc.
 - c. Donn Corporation
 - d. Armstrong

2..2 ACOUSTICAL CEILING UNITS, GENERAL

- A. Standard for Acoustical Ceiling Units: Provide manufacturers' standard units of configuration indicated that comply with ASTM E 1264 classifications as designated by reference to types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
 1. Mounting Method for Measuring NRC: Type E-400 (plenum mounting in which face of test specimen is 15-3/4 inches [400 mm] away from the test surface) per ASTM E 795.
- B. Colors and Patterns: White 2x2 - Armstrong Commercial Ceiling Products

2..3 METAL SUSPENSION SYSTEMS, GENERAL

- A. Standard for Metal Suspension Systems: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.
- B. Finishes and Colors: Provide manufacturer's standard factory-applied finish for type of system

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indicated.

- C. Attachment Devices: Size for 5 times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.
- D. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.
 - 1. Gage: Provide wire sized so that stress at 3 times hanger design load (ASTM C 635, Table 1, Direct-Hung), will be less than yield stress of wire, but provide not less than 0.106-inch diameter (12 gage).
- E. Hanger Rods: Mild steel, zinc coated, or protected with rust-inhibitive paint.
- F. Flat Hangers: Mild steel, zinc coated, or protected with rust-inhibitive paint.
- G. Angle Hangers: Angles with legs not less than 7/8 inch wide, formed with 0.0365-inch-thick galvanized steel sheet complying with ASTM A 446, Coating Designation G90, with bolted connections and 5/16-inch-diameter bolts.
- H. Edge Moldings and Trim: Metal or extruded aluminum of types and profiles indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit type of edge detail and suspension system indicated.
 - 1. 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. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
 - 3. For acoustical tile adhered to substrate, provide edge moldings at ceiling perimeters and where indicated.
- I. Hold-Down Clips for Non-Fire-Resistance-Rated Ceilings: For interior ceilings composed of lay-in panels weighing less than 1 lb per sq. ft., provide hold-down clips spaced 2'-0" o.c. on all cross-tees.
- J. Impact Clips: Where indicated, provide manufacturer's standard impact clip system design to absorb impact forces against lay-in panels.

2..4 NON-FIRE-RESISTANCE-RATED DIRECT-HUNG SUSPENSION SYSTEMS

- A. Wide-Face Single-Web Steel Suspension System: Main and cross-runners roll-formed from prepainted or electrolytic zinc-coated cold-rolled steel sheet, with prepainted 15/16-inch-wide flanges; other characteristics as follows:
 - 1. Structural Classification: Intermediate-Duty System.
 - 2. Finish: Painted, white.

2..5 MISCELLANEOUS MATERIALS

- A. Concealed Acoustical Sealant: Nondrying, nonhardening, nonskinning, nonstaining, nonbleeding, gunnable sealant complying with requirement specified in Division 7 Section "Joint Sealers."

PART 3 - EXECUTION

ACOUSTICAL PANEL CEILINGS

3..1 EXAMINATION

- A. Examine substrates and structural framing to which ceiling system attaches or abuts, with Installer present, for compliance with requirements specified in this and other sections that affect installation and anchorage of ceiling system. Do not proceed with installation until unsatisfactory conditions have been corrected.

3..2 PREPARATION

- A. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.
 - 1. Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.
- B. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less-than-half-width units at borders, and comply with reflected ceiling plans.

3..3 INSTALLATION

- A. General: Install acoustical ceiling systems to comply with installation standard referenced below, per manufacturer's instructions and CISCA "Ceiling Systems Handbook."
 - 1. Standard for Installation of Ceiling Suspension Systems: Comply with ASTM C 636.
- B. Arrange acoustical units and orient directionally patterned units in a manner shown by reflected ceiling plans.
- C. Suspend ceiling hangers from building 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 structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the 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. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
 - 3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 4. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eyescrews, or other devices that are secure and appropriate for structure to which hangers are attached as well as for type of hanger involved, and in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 - 5. Space hangers not more than 4'-0" o.c. along each member supported directly from hangers, unless otherwise shown, and provide hangers not more than 8 inches from ends of each member.
- D. Install edge moldings of type indicated at perimeter of acoustical ceiling area and where

necessary to conceal edges of acoustical units.

1. Sealant Bed: Apply continuous ribbon of acoustical sealant, concealed on back of vertical leg before installing moldings.
 2. Screw-attach moldings to substrate at intervals not over 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to tolerance of 1/8 inch in 12'-0". Miter corners accurately and connect securely.
- E. Install acoustical panels in coordination with suspension system, with edges concealed by support of suspension members. Scribe and cut panels to fit accurately at borders and at penetrations.
1. Install hold-down clips in areas indicated and in areas where required by governing regulations or for fire-resistance ratings; space as recommended by panel manufacturer, unless otherwise indicated or required.

3.4 CLEANING

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

END OF SECTION 095110

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SECTION 096800 - CARPET TILE

1.1 GENERAL

- A. Submittals: As follows:
 - 1. Product Data for each type of product indicated.
 - 2. Shop Drawings showing carpet tile type, color, and dye lot; type of subfloor; type of installation; pattern of installation; pattern type, location, and direction; type, color, and location of insets and borders.
 - 3. Samples for each product indicated.
 - 4. Product schedule using same room and product designations indicated on Drawings and in schedules.
 - 5. Maintenance data for carpet tile to include in maintenance manuals specified in Division 1.
- B. Comply with CRI 104, Section 5, "Storage and Handling," and Section 6.1, "Site Conditions; Temperature and Humidity."
- C. Do not install carpet tile over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
- D. Extra Materials: Furnish full-size units equal to 5 percent of amount installed for each type of carpet tile indicated, but not less than 10 sq. yd. (8.3 sq. m).

2.1 PRODUCTS

- A. Carpet Tile: As follows:
 - 1. Available Product[s]: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - A. Shaw – Type: Visible, Color: Beam
 - B. Milliken – Obex Entrance Flooring, Grid CutX 11mm closed
 - 2. Product: Subject to compliance with requirements, provide the following:
 - A. Shaw – Type: Visible, Color: Beam
 - B. Milliken – Obex Entrance Flooring, Grid CutX 11mm closed

3.1 EXECUTION

- A. Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Verify that substrates and conditions are satisfactory for carpet tile installation and comply with requirements specified.
 - 1. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and slabs are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
- B. Preparation: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
- C. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

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- D. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents.
- E. Installation: Comply with CRI 104, Section 13, "Carpet Modules (Tiles)."
- F. Cut and fit carpet tile 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 tile manufacturer.
- G. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- H. Install pattern parallel to walls and borders.
- I. Perform the following operations immediately after installing carpet tile:
 - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 - 2. Remove yarns that protrude from carpet tile surface.
 - 3. Vacuum carpet tile using commercial machine with face-beater element.
- J. Protect installed carpet tile to comply with CRI 104, Section 15, "Protection of Indoor Installations."

END OF SECTION 096810

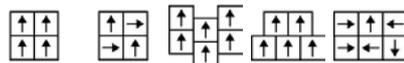
visible tile

product type: **carpet tile**
 collection: **Light Series**
 style number: **5T002**
 construction: **multi-level pattern loop**
 fiber: **eco solution a® nylon**
 dye method: **100% solution dyed**
 primary backing: **synthetic**
 secondary backing: **ecoworx® tile**
 protective treatments: **ssp® shaw soil protection**
 warranty: **lifetime commercial limited**

	u.s.	metric
product size:	24.0 x 24.0 inches	61.0 x 61.0 cm
gauge:	1/12 inch	47.2 per 10cm
stitches:	10 per inch	39 per 10cm
finished pile thickness:	0.108 inches	2.74 mm
average density:	6667 per cu.yd.	0.247 g/cm3
kilotex:		10.98 kilotex
total thickness:	0.239 inches	6.07 mm
tufted weight:	20.0 oz/yd2	678.1 gms/sqm
gsa approved product	true	



recommended installation method



monolithic quarter turn ashlar brick random

coordinating products

carpet tile: vibrant tile, absorbed tile

performance + testing

antimicrobial assessment: **passes (AATCC-174) (When installed using Shaw 5036 adhesive)**
 pill test: **pass**
 radiant panel: **class I**
 nbs smoke: **less than 450**
 electrostatic propensity: **less than 3.5 kv**
 CRI greenlabel plus: **USA (GLP9968)**
 ADA compliance: **This product meets the guidelines as set forth in the Americans with Disabilities Act for minimum static coefficient of friction of 0.6 for accessible routes.**

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june 20, 2019

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product transparency

Shaw Contract is dedicated to providing clients with a building chemistry that's safe and dependable. Working together, we will help you meet your goals as they pertain to material health. EcoWorx products with Eco Solution Q nylon are Cradle to Cradle Certified (tm) Silver and assessed for impacts on human health and the environment. This product can be recycled. When it's time to replace, we can collect and recycle it through our Environmental Guarantee.*

attributes + certifications

Cradle to Cradle Certified™	silver level (version 3.1)
Health Product Declaration (HPD):	1,000 ppm disclosure
Environmental Product Declaration (EPD):	3rd party certified in accordance with ISO14044, ISO14025 & EN15804
Living Building Challenge (LBC):	free of red list chemicals
Declare:	LBC compliant
nsf 140:	gold
CRI Green Label Plus (GLP):	USA (GLP9968)
Building Research Establishment (BRE):	certified
Good Environmental Choice Australia (GECA):	certified
Singapore Green Label:	039-003
ce marking (EN 14041):	3rd party certified
environmental guarantee*:	free pickup & delivery available north america
total recycled content:	44% (post industrial 44% post consumer 0%)
product packaging:	100% recyclable
country of origin**:	USA

green leed contribution credit

MR Credit: Building Product Disclosure and Optimization Environmental Product Declarations - Option 1. Environmental Product Declaration (EPD)	3rd party certified in accordance with ISO14044, ISO14025 & EN15804
MR Credit: Building Product Disclosure and Optimization Material Ingredients - Option 1: Material Ingredient Reporting	HPD (version 2.1) or C2C silver level (version 3.1)
MR Credit: Building Product Disclosure and Optimization Material Ingredients - Option 2. Material Ingredient Optimization	C2C silver level (version 3.1)
MR Credit: Building Product Disclosure and Optimization Sourcing of Raw Materials - Option 2: Leadership Extraction Practices	environmental guarantee: free pickup & delivery available north america
EQ Credit: Low Emitting Materials Option 1. Product Category Calculations	green label plus certification: GLP9968
MR Credit: Interiors Life-Cycle Impact Reduction Option 3. Design for Flexibility	ecoworx tile w/ lokdots installation system

additional information

* To learn more about the recyclability of our products and our Environmental Guarantee, please visit shawcontract.com.

**Meets or exceeds all local and national regulations in country of manufacture.



specifications are subject to nominal manufacturing variances. material supply and/or manufacturing processes may necessitate specification changes without notice. this carpet is an exclusive design and may not be duplicated in any manner. use of this design in the creation of another carpet design is also strictly prohibited. visit shawcontract.com/testing for more information.

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June 20, 2019

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GRID

OBEX™ CutX 11mm Closed

SPECIFICATION SHEET DATE: 29 APRIL 2019

MODULAR GRID

Grid Material

100% UV-Resistant PVC

Grid Size

Nominal: 7.87" x 7.87" (200 mm x 200 mm)
Installed Usable: 7.677" x 7.677" (195 mm x 195 mm)

Nominal Total Thickness

0.43" (11 mm)

Grid Color

Black

Outdoor Temperature Resistance

-22 °F to +122°F (-30°C to 50°C)

Nominal Total Weight

28.84 oz/ft² (8,800 g/m²)

Recommended Maintenance

Hot Water Extraction or Pressure Wash

Rolling Load Weight - Freelaid

1,102 lb. (500 Kg)

Rolling Load Weight - Glued

2,205 lb. (1,000 Kg)

Tiles Per Box

30 pieces

ADA / BS 8300 / ISO 2152 Compliant

TEXTILE

Textile Construction

Tufted, Cut Pile

Textile Yarn Type

Milliken-Certified WearOn® Nylon Type 6 and 6,6

Textile Dye Method

DDI (Digital Dye Infusion)

Lightfastness (AATCC 16E)

≥ 4.0 at 80 Hours

Crocking (AATCC 165)

≥ 4.0 Wet or Dry

WARRANTIES

1-Year Manufacturing Defect Warranty

5-Year Wear Warranty

This product is covered by one or more patents, published applications and/or patents pending. Specifications are subject to normal manufacturing tolerances and may be changed without prior notice. Copies of actual test results are available upon request.

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SECTION 099000 - PAINTING

PART 1 - GENERAL

1..1 RELATED DOCUMENTS

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

1..2 SUMMARY

- A. This Section includes surface preparation, painting, and finishing of exposed interior and exterior items and surfaces.
 - 1. Surface preparation, priming, and finish coats specified in this section are in addition to shop priming and surface treatment specified under other sections.
- B. Paint exposed surfaces whether or not colors are designated in "schedules," except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Architect will select from standard colors or finishes available.
 - 1. Painting includes field painting exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.
- C. Painting is not required on prefinished items, finished metal surfaces, concealed surfaces, operating parts, and labels.
 - 1. Prefinished items not to be painted include the following factory-finished components:
 - a. Metal toilet enclosures.
 - b. Acoustic materials.
 - c. Architectural woodwork and casework.
 - d. Finished mechanical and electrical equipment.
 - e. Light fixtures.
 - f. Switchgear.
 - g. Distribution cabinets.
 - 2. Concealed surfaces not to be painted include wall or ceiling surfaces in the following generally inaccessible areas:
 - a. Foundation spaces.
 - b. Furred areas.
 - c. Utility tunnels.
 - d. Pipe spaces.
 - e. Duct shafts.
 - 3. Finished metal surfaces not to be painted include:
 - a. Anodized aluminum.
 - b. Stainless steel.
 - c. Chromium plate.
 - d. Copper.
 - e. Bronze.
 - f. Brass.
 - 4. Operating parts not to be painted include moving parts of operating equipment such as the following:
 - a. Valve and damper operators.

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- b. Linkages.
 - c. Sensing devices.
 - d. Motor and fan shafts.
5. Labels: Do not paint over Underwriter's Laboratories, Factory Mutual or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
- D. Related Sections: The following sections contain requirements that relate to this section:
- 1. Division 5 Section "Structural Steel" for shop priming structural steel.
 - 2. Division 4 Section "Masonry" for sealing of all block products.

1..3 DEFINITIONS

- A. "Paint" includes coating systems materials, primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate, or finish coats.

1..4 SUBMITTALS

- A. Product Data: Manufacturer's technical information, label analysis, and application instructions for each material proposed for use.
- 1. List each material and cross-reference the specific coating and finish system and application. Identify each material by the manufacturer's catalog number and general classification.
- B. Samples for verification purposes: Provide samples of each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate. Define each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture are achieved.
- 1. Provide a list of material and application for each coat of each sample. Label each sample as to location and application.
 - 2. Submit samples on the following substrates for the Architect's review of color and texture only:
 - a. Concrete: Provide two 4-inch-square samples for each color and finish.
 - b. Concrete Masonry: Provide two 4- by-8-inch samples of masonry, with mortar joint in the center, for each finish and color.
 - c. Painted Wood: Provide two 12- by 12-inch samples of each color and material on hardboard.
 - d. Stained or Natural Wood: Provide two 4- by 8-inch samples of natural and stained wood finish on actual wood surfaces.
 - e. Ferrous Metal: Provide two 4-inch-square samples of flat metal and two 8-inch-long samples of solid metal for each color and finish.

1..5 QUALITY ASSURANCE

- A. Single-Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats.
- B. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total systems for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
- 1. Notify the Architect of problems anticipated using the materials specified.
- C. Field Samples: On wall surfaces and other exterior and interior components, duplicate finishes of prepared samples. Provide full- coat finish samples on at least 100 sq. ft. of surface until required

sheen, color and texture are obtained; simulate finished lighting conditions for review of in-place work.

1. Final acceptance of colors will be from job-applied samples.
2. The Architect will select one room or surface to represent surfaces and conditions for each type of coating and substrate to be painted. Apply coatings in this room or surface in accordance with the schedule or as specified. After finishes are accepted, this room or surface will be used for evaluation of coating systems of a similar nature.

D. Material Quality: Provide the manufacturer's best quality trade sale paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary names used to designate colors or materials are not intended to imply that products named are required or to exclude equal products of other manufacturers.
2. Federal Specifications establish a minimum quality level for paint materials, except where other product identification is used. Provide written certification from the manufacturer that materials provided meet or exceed these criteria.
3. Products that comply with qualitative requirements of applicable Federal Specifications, yet differ in quantitative requirements, may be considered for use when acceptable to the Architect. Furnish material data and manufacturer's certificate of performance to Architect for proposed substitutions.

1..6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the job site in the manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:

1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Federal Specification number, if applicable.
4. Manufacturer's stock number and date of manufacture.
5. Contents by volume, for pigment and vehicle constituents.
6. Thinning instructions.
7. Application instructions.
8. Color name and number.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1..7 JOB CONDITIONS

A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 deg F (10 deg C) and 90 deg F (32 deg C).

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 deg F (7 deg C) and 95 deg F (35 deg C).

C. Do not apply paint in snow, rain, fog, or mist, when the 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.

1. Painting may continue during inclement weather if surfaces and areas to be painted are

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enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.

PART 2 - PRODUCTS

2..1 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
 - 1. Benjamin Moore and Co. (Moore).
 - 2. The Sherwin-Williams Company (S-W).

PART 3 - EXECUTION

2..2 EXAMINATION

- A. Examine substrates and conditions under which painting will be performed for compliance with requirements for application of paint. Do not begin paint application until unsatisfactory conditions have been corrected.
 - 1. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

2..3 PREPARATION

- A. General Procedures: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items in place that are not to be painted, or provide surface-applied protection prior to surface preparation and painting. Remove these items if necessary for complete painting of the items and adjacent surfaces. Following completion of painting operations in each space or area, have items reinstalled by workers skilled in the trades involved.
 - 1. Clean surfaces before applying paint or surface treatments. Remove oil and grease prior to cleaning. Schedule cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- B. Surface Preparation: Clean and prepare surfaces to be painted in accordance with the manufacturer's instructions for each particular substrate condition and as specified.
 - 1. Provide barrier coats over incompatible primers or remove and reprime. Notify Architect in writing of problems anticipated with using the specified finish-coat material with substrates primed by others.
 - 2. Cementitious Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
 - a. Use abrasive blast-cleaning methods if recommended by the paint manufacturer.
 - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
 - c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, and rinse; allow to dry and vacuum before painting.
 - 3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.

- a. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer before application of primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
 - b. Prime, stain, or seal wood to be painted immediately upon delivery. Prime edges, ends, faces, undersides, and backsides of wood, including cabinets, counters, cases, and paneling.
 - c. When transparent finish is required, backprime with spar varnish.
 - d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on backside.
 - e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately upon delivery.
4. Ferrous Metals: Clean nongalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with recommendations of the Steel Structures Painting Council.
- a. Blast steel surfaces clean as recommended by the paint system manufacturer and in accordance with requirements of SSPC specification SSPC-SP 10.
 - b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
 - c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by the paint manufacturer, and touch up with the same primer as the shop coat.
5. Galvanized Surfaces: Clean galvanized surfaces with non-petroleum-based solvents so that the surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- C. Materials Preparation: Carefully mix and prepare paint materials in accordance with manufacturer's directions.
1. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.
 2. Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.
 3. Use only thinners approved by the paint manufacturer, and only within recommended limits.
- D. Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

2..4 APPLICATION

- A. Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.
- B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
1. Paint colors, surface treatments, and finishes are indicated in "schedules."
 2. Provide finish coats that are compatible with primers used.
 3. The number of coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce an even

- smooth surface in accordance with the manufacturer's directions.
 4. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform finish, color, and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.
 5. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned tube radiation, grilles, and similar components are in place. Extend coatings in these areas as required to maintain the system integrity and provide desired protection.
 6. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only before final installation of equipment.
 7. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, nonspecular black paint.
 8. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
 9. Finish interior of wall and base cabinets and similar field- finished casework to match exterior.
 10. Finish exterior doors on tops, bottoms, and side edges same as exterior faces.
 11. Sand lightly between each succeeding enamel or varnish coat.
 12. Omit primer on metal surfaces that have been shop-primed and touch up painted.
- C. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. Allow sufficient time between successive coats to permit proper drying. Do not recoat until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure and where application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.
 2. AT INTERIOR WALL SURFACES, PAINTING SHALL TAKE PLACE IN (2) PHASES. THE FIRST (2) COATS OF PAINT TO BE SCHEDULED AT COMPLETION OF GYPSUM WALL AND CEILING ASSEMBLIES (MUDDING TAPING AND SANDING). FINAL COAT OF PAINT TO BE APPLIED JUST PRIOR TO SUBSTANTIAL COMPLETION (AT TIME AGREED APON BETWEEN ARCHITECT, OWNER AND GENERAL CONTRACTOR)
- D. Minimum Coating Thickness: Apply materials at not less than the manufacturer's recommended spreading rate. Provide a total dry film thickness of the entire system as recommended by the manufacturer.
- E. Prime Coats: Before application of finish coats, apply a prime coat of material as recommended by the manufacturer to material that is required to be painted or finished and has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to assure a finish coat with no burn through or other defects due to insufficient sealing.
- F. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- G. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections.
1. Provide satin finish for final coats.
- H. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or

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repaint work not in compliance with specified requirements.

2..5 FIELD QUALITY CONTROL

- A. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary during the period when paint is being applied:
 - 1. Engage the services of an independent testing laboratory to sample the paint material being used. Samples of material delivered to the project will be taken, identified, sealed, and certified in the presence of the Contractor.
 - 2. If test results show material being used does not comply with specified requirements, the Contractor may be directed to stop painting, remove noncomplying paint, pay for testing, repaint surfaces coated with rejected paint, and remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are noncompatible.

2..6 CLEANING

- A. Cleanup: At the end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
- B. Upon completion of painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping, using care not to scratch or damage adjacent finished surfaces.

2..7 PROTECTION

- A. Protect work of other trades, whether to be painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.
- B. Provide "wet paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.
 - 1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. ENTIRE WALL PLANE OF DAMAGED WALL SURFACES TO BE REPAINTED IF TOUCH-UP REQUIRED. NO SPOT TOUCH-UPS.

2..8 PAINT SCHEDULE

- A. General: Provide the following paint systems for the various substrates indicated.
- B. Ferrous Metal; Includes hollowmetal doors and frames.
 - 1. First Coat: Speedhide Latex Gloss Enamel.
 - 2. Second Coat: Speedhide Latex Gloss Enamel.
 - 3. Not less than 5.6 mils total dry film thickness.
 - 4. Not less than 4.0 mils dry film thickness, excluding primer coat.
- C. Gypsum Drywall Systems: Painted on Walls and Ceilings.
 - 1. First Coat: Speedhide Quick-Drying latex Primer Sealer.
 - 2. Second Coat: Speedhide Latex eggshell Enamel.
 - 3. Third Coat: Speedhide latex eggshell Enamel.
 - 4. Not less than 5.- mils total dry film thickness.

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- 5. Ceiling Paint to be eggshell.
- D. Solid Core Doors: Prefinished Wood Doors – See materials list at front of project manual.
- E. Gutters and Downspouts: Factory Finished.
- F. Concrete:
 - 1. Match Sherwin Williams H&C Silicone Acrylic Concrete Sealer. Color by Architect.

END OF SECTION 099000

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SECTION 105220 - FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

PART 1 - GENERAL

1..1 RELATED DOCUMENTS:

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

1..2 DESCRIPTION OF WORK:

- A. Extent of fire extinguishers, cabinets and accessories is indicated on drawings.
- B. Definition: "Fire extinguishers" as used in this section refers to units which can be hand-carried as opposed to those which are equipped with wheels or to fixed fire extinguishing systems.
- C. Types of products required include:
 - 1. Fire extinguishers.
 - 2. Fire extinguisher cabinets.
 - 3. Mounting brackets.

1..3 QUALITY ASSURANCE:

- A. Single Source Responsibility: Obtain products in this section from one manufacturer.
- B. Coordination: Verify that fire extinguisher cabinets are sized to accommodate fire extinguishers of type and capacity indicated.
- C. UL-Listed Products: Provide new portable fire extinguishers which are UL-listed and bear UL "Listing Mark" for type, rating, and classification of extinguisher indicated.
- D. FM Listed Products: Provide new portable fire extinguishers which are approved by Factory Mutual Research Corporation for type, rating, and classification of extinguisher indicated and carry appropriate FM marking.

1..4 SUBMITTALS:

- A. Product Data: Submit product data for each type of product included in this section. For fire extinguisher cabinets include roughing-in dimensions and details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type and materials, trim style and door construction, and panel style and materials.
- B. Samples: Submit for verification purposes, samples of each required finish. Prepare samples on metal of same gage as used for actual production run. Where normal color variations are to be expected, include 2 or more units in each sample set showing limits of variation.
 - 1. For initial selection of colors and finishes, submit manufacturer's color cards showing full range of standard colors available.

PART 2 - PRODUCTS

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2..1 ACCEPTABLE MANUFACTURERS:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
 - 1. J.L. Industries
 - 2. Larsen's Mfg. Co.
 - 3. Muckle Manufacturing, Division of Technico, Inc.
 - 4. Watrous, Inc.
 - 5. Accessory Specialties.

2..2 FIRE EXTINGUISHERS:

- A. General: Provide fire extinguishers for each extinguisher cabinet and other locations indicated, in colors and finishes selected by Architect from manufacturer's standard which comply with requirements of governing authorities.
 - 1. Fill and service extinguishers to comply with requirements of governing authorities and manufacturer's requirements.
- B. Abbreviations indicated below to identify extinguisher types related to UL classification and rating system and not, necessarily to type and amount of extinguishing material contained in extinguisher.
- C. Multi-Purpose Dry Chemical Type: UL-rated 4-A:6-B:C, 10 lb. nominal capacity, in enameled steel container, for Class A, Class B and Class C fires.

2..3 MOUNTING BRACKETS:

- A. Provide manufacturer's standard brackets designed to prevent accidental dislodgement of extinguisher, of sizes required for type and capacity of extinguisher indicated, in manufacturer's standard plated finish.
 - 1. Provide brackets for extinguishers not located in cabinets and for those located in cabinets.

2..4 FIRE EXTINGUISHER CABINETS:

- A. General: Provide fire extinguisher suitable size for housing fire extinguishers of types and capacities indicated.
- B. Construction: Manufacturer's standard enameled steel box, with trim, frame, door and hardware to suit cabinet type, trim style, and door style indicated. Weld all joints and grind smooth. Miter and weld perimeter door frames.
- C. Cabinet Type: Suitable for mounting conditions indicated, of the following types:
 - 1. Semi-Recessed: Cabinet box (tub) partially recessed in walls of shallow depth.
- D. Trim Style: Fabricate trim in one piece with corners mitered, welded and ground smooth.
 - 1. Trimless: For installation in walls where surface of surrounding wall finishes flush with exterior finished surface of frame and door of fire extinguisher cabinet, without any overlapping trim attached to cabinet.
 - 2. Provide recessed flange, of same material as box, attached to box to act as plaster stop.
- E. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall

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surface with exposed trim face and wall return at outer edge (backbend).

1. Rolled-Edge Trim: Rounded edges with backbend depth as follows:
 - a. Depth: 1-1/4".
 2. Square-Edge Trim: Square edges with backbend depths as follows:
 - a. 1/4" TO 5/16".
 3. Trim Metal: Stainless steel, ASTM A 167, AISI Type 302/304 alloy.
- F. Door Material and Construction: Manufacturer's standard door construction, of material indicated, coordinated with cabinet types and trim styles selected.
1. Stainless Steel: Manufacturer's standard door construction, fabricated from austenitic stainless steel complying with ASTM A 167, for AISI Type 302/304 alloy.
 2. Door Glazing: Clear float glass complying with FS DD-G-451, type I, class 1, quality q3.
- G. Door Style: Manufacturer's standard design as indicated below and on drawings.
1. Full-Glass Panel: Float glass, 1/8" thick.
- H. Door Hardware: Provide manufacturer's standard door operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam action latch, or door pull, exposed or concealed, and friction latch. Provide concealed or continuous type hinge permitting door to open 180 degrees.

2..5 FACTORY FINISHING OF FIRE EXTINGUISHER CABINETS:

- A. General: Comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations except as otherwise indicated. Apply finishes in factory after products are assembled. Protect cabinets with plastic or paper covering, prior to shipment.
- B. Painted Finishes: Provide painted finish to comply with requirements indicated below for extent, preparation and type:
1. Extent of Painted Finish: Apply painted finish to both concealed and exposed surfaces of cabinet components except where other than a painted finish is indicated.
 2. Color: Provide color or color matches indicated, or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors.
 3. Preparation: Clean surfaces of dirt, grease, and loose rust or mill scale.
 4. Baked Enamel Finish: Immediately after cleaning and pretreatment, apply cabinet manufacturer's standard baked enamel finish system to the following surfaces:
 - a. Interior of cabinet.
 - b. Exterior of cabinet except for those surfaces indicated to receive another finish.
- C. Stainless Steel Finish: AISI No. 4 polished finish. Furnish with paper masking to protect finish.

PART 3 - EXECUTION

3..1 INSTALLATION:

- A. Install items included in this section in locations and at mounting heights indicated, or if not indicated,

at heights to comply with applicable regulations of governing authorities.

1. Prepare recesses in walls for fire extinguisher cabinets as required by type and size of cabinet and style of trim and to comply with manufacturer's instructions.
2. Securely fasten mounting brackets and fire extinguisher cabinets to structure, square and plumb, to comply with manufacturer's instructions.
3. Where exact location of surface-mounted cabinets and bracket-mounted fire extinguishers is not indicated, locate as directed by Architect.

3.2 IDENTIFICATION:

- A. Identify existence of fire extinguisher in cabinet with lettering spelling "FIRE EXTINGUISHER" applied to door by process indicated below. Provide lettering to comply with requirements indicated for letter style, color, size, spacing and location or, if not otherwise indicated, as selected by Architect from manufacturer's standard arrangements.
 1. Application Process: Silk screen.

END OF SECTION 105220

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SECTION 108000 - TOILET AND BATH ACCESSORIES & SIGNS

PART 1 - GENERAL

1..1 RELATED DOCUMENTS:

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

1..2 DESCRIPTION OF WORK:

- A. Extent of each type of toilet accessory is indicated on drawings and schedules.
- B. Types of toilet accessories required include the following:
 - 1. Toilet tissue dispenser.
 - 2. Towel dispenser and Hand Dryer units.
 - 3. Grab bar.
 - 4. Sanitary napkin disposal unit.
 - 5. Soap dispensers
 - 6. Mirror Units.

1..3 QUALITY ASSURANCE:

- A. Inserts and Anchorages: Furnish inserts and anchoring devices which must be set in concrete or built into masonry; coordinate delivery with other work to avoid delay.
- B. Accessory Locations: Coordinate accessory locations with other work to avoid interference and to assure proper operation and servicing of accessory units.
- C. Products: Provide products of same manufacturer for each type of accessory unit and for units exposed in same areas, unless otherwise acceptable to Architect.

1..4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical data and installation instructions for each toilet accessory.

PART 2 - PRODUCTS

2..1 ACCEPTABLE MANUFACTURERS:

- A. Manufacturers: Subject to compliance with requirements, provide toilet accessories by the following:
 - 1. Bradley Corporation

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2..2 MATERIALS, GENERAL:

- A. Stainless Steel: AISI Type 302/304, with polished No. 4 finish, 22 gage (.034") minimum, unless otherwise indicated.
- B. Fasteners: Screws, bolts, and other devices of same material as accessory unit or of galvanized steel where concealed.
- C. Mirror Glass: Nominal 6.0 mm (0.23 inch) thick, conforming to ASTM C 1036, Type I, Class 1, Quality q2, and with silvering, electro-plated copper coating, and protective organic coating.

2..3 TOILET TISSUE DISPENSERS:

- A. Bradley 5A10-11

2..4 HAND DRYER:

- A. Bradley 2923-287400

2..5 GRAB BARS:

- A. Bradley 18" 8120-001180, 36" 8120-001360, 42" 8120-001420

2..6 SANITARY NAPKIN DISPOSAL UNITS:

- A. Bradley 4A10-11

2..7 SOAP DISPENSERS:

- C. Bradley 6A01
- B. Bradley 6-3500-R-F-T-BS-A14-029

2..8 MIRROR UNITS

- C. Bradley 781-2436

2..9 SIGNS

- C. Provide the following signs from Mohawk Sign Company:
 - 1. Mens Restroom - #M203-6VM.
 - 2. Womens Restroom - #W203-6WC.
 - 3. Break Room - #M201-9PM - (This shall read "BREAK ROOM").

2..10 FABRICATION:

- C. General: Only an unobtrusive stamped logo of manufacturer, as approved by Architect, is permitted on exposed face of toilet or bath accessory units. On either interior surface not exposed to view or back surface, provide additional identification by means of either a printed, waterproof label or a stamped nameplate, indicating manufacturer's name and product model number.
- D. General: No names or labels are permitted on exposed faces of toilet and bath accessory units. On

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either interior surface not exposed to view or on back surface, provide identification of each accessory item by either a printed, waterproof label or a stamped nameplate indicating manufacturer's name and product model number.

- E. Surface-Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage wherever possible.
- F. Recessed Toilet Accessories, General: Except where otherwise indicated, fabricate units of all welded construction, without mitered corners. Hang doors or access panels with full-length stainless steel piano hinge. Provide anchorage which is fully concealed when unit is closed.

PART 3 - EXECUTION

3..1 INSTALLATION:

- A. Install toilet accessory units in accordance with manufacturers' instructions, using fasteners which are appropriate to substrate and recommended by manufacturer of unit. Install units plumb and level, firmly anchored in locations and at heights indicated.

3..2 ADJUSTING AND CLEANING:

- A. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.
- B. Clean and polish all exposed surfaces after removing temporary labels and protective coatings.

END OF SECTION 108000

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DIVISION 26 - ELECTRICAL

260519	Low-voltage Electrical Power Conductors And Cables
260523	Control-voltage Electrical Power Cables
260526	Grounding And Bonding For Electrical Systems
260529	Hangers And Supports For Electrical Systems
260533	Raceways And Boxes For Electrical Systems
260548	Vibration And Seismic Controls For Electrical Systems
260553	Identification For Electrical Systems
260923	Lighting Control Devices
260943	Relay-Based Lighting Controls
262416	Panelboards
262726	Wiring Devices
262816	Enclosed Switches and Circuit Breakers
262913	Enclosed Controllers
265100	Interior Lighting

END OF TABLE OF CONTENTS

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SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.
- B. Related Requirements:
 - 1. Section 271500 "Communications Horizontal Cabling" for cabling used for voice and data circuits.

1.3 QUALITY ASSURANCE

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Aluminum and Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- B. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2 Type and XHHW-2.
- C. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for metal-clad cable, Type MC and Type SOW with ground wire.

2.2 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

- 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. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Solid or stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid or stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and larger, except VFC cable, which shall be extra flexible stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN-2-THWN-2, single conductors in raceway or Type XHHW-2, single conductors in raceway.
- B. Feeders: Type THHN-2-THWN-2, single conductors in raceway or Type XHHW-2, single conductors in raceway.
- C. Exposed Branch Circuits, Including in Crawlspace: Type THHN-2-THWN-2, single conductors in raceway.
- D. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single conductors in raceway or Metal-clad cable, Type MC.
- E. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.
- F. Cord Drops and Portable Appliance Connections: Type SOW, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

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- G. Complete cable tray systems installation according to Section 260536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

END OF SECTION 260519

SECTION 260523 - CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Category 5e balanced twisted pair cable.
 - 2. Balanced twisted pair cabling hardware.
 - 3. RS-485 cabling.
 - 4. Low-voltage control cabling.
 - 5. Control-circuit conductors.

1.2 DEFINITIONS

- A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

PART 2 - PRODUCTS

2.1 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. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262, by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.
 - 1. Flame Travel Distance: 60 inches (1520 mm) or less.
 - 2. Peak Optical Smoke Density: 0.5 or less.
 - 3. Average Optical Smoke Density: 0.15 or less.
- C. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.
- D. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.
- E. RoHS compliant.

2.2 CATEGORY 5e BALANCED TWISTED PAIR CABLE

- A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 5e cable at frequencies up to 100 MHz.
- B. Standard: Comply with ICEA S-90-661, NEMA WC 63.1, and TIA-568-C.2 for Category 5e cables.

- C. Conductors: 100-ohm, 24 AWG solid copper.
- D. Shielding/Screening: Unshielded twisted pairs (UTP) or Shielded twisted pairs (FTP) per manufacturer's requirements for associated system.
- E. Cable Rating: Plenum.
- F. Jacket: Gray thermoplastic.

2.3 BALANCED TWISTED PAIR CABLE HARDWARE

- A. Description: Hardware designed to connect, splice, and terminate balanced twisted pair copper communications cable.
- B. General Requirements for Balanced Twisted Pair Cable Hardware:
 - 1. Comply with the performance requirements of Category 5e.
 - 2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
 - 3. Cables shall be terminated with connecting hardware of same category or higher.
- C. Source Limitations: Obtain balanced twisted pair cable hardware from same manufacturer as balanced twisted pair cable, from single source.
- D. Connecting Blocks: 110-style IDC for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare, integral with connector bodies, including plugs and jacks where indicated.
- E. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.
 - 1. Number of Terminals per Field: One for each conductor in assigned cables.
- F. Patch Cords: Factory-made, four-pair cables in required lengths; terminated with an eight-position modular plug at each end.
 - 1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords shall have latch guards to protect against snagging.
 - 2. Patch cords shall have color-coded boots for circuit identification.
- G. Plugs and Plug Assemblies:
 - 1. Male; eight position; color-coded modular telecommunications connector designed for termination of a single four-pair 100-ohm unshielded or shielded balanced twisted pair cable.
 - 2. Comply with IEC 60603-7-1, IEC 60603-7-2, IEC 60603-7-3, IEC 60603-7-4, and IEC 60603-7.5.
 - 3. Marked to indicate transmission performance.
- H. Jacks and Jack Assemblies:
 - 1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair 100-ohm unshielded or shielded balanced twisted pair cable.
 - 2. Designed to snap-in to a patch panel or faceplate.
 - 3. Standards.
 - a. Category 5e, unshielded balanced twisted pair cable shall comply with IEC 60603-7-2.
 - b. Category 5e, shielded balanced twisted pair cable shall comply with IEC 60603-7-3.

- c. Category 6, unshielded balanced twisted pair cable shall comply with IEC 60603-7-4.
 - d. Category 6, shielded balanced twisted pair cable shall comply with IEC 60603-7.5.
 - e. Category 6a, unshielded balanced twisted pair cable shall comply with IEC 60603-7-41.
 - f. Category 6a, shielded balanced twisted pair cable shall comply with IEC 60603-7.51.
4. Marked to indicate transmission performance.

2.4 TWIN-AXIAL DATA HIGHWAY CABLE

- A. Plenum-Rated Cable: NFPA 70, Type CMP.
- 1. Paired, quantity of pairs per manufacturer requirements for associated system, No. 20 AWG minimum, stranded (7x28) tinned-copper conductors.
 - 2. Plastic insulation.
 - 3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
 - 4. Plastic jacket.
 - 5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned-copper drain wire.
 - 6. Flame Resistance: Comply with NFPA 262.

2.5 RS-485 CABLE

- A. Plenum-Rated Cable: NFPA 70, Type CMP.
- 1. Paired, one pair or two pairs as required by manufacturer of associated system, No. 22 AWG, stranded (7x30) tinned-copper conductors.
 - 2. Fluorinated ethylene propylene insulation.
 - 3. Unshielded.
 - 4. Flame Resistance: NFPA 262.

2.6 LOW-VOLTAGE CONTROL CABLE

- A. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
- 1. One, or Multi-pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
 - 2. PVC insulation.
 - 3. Unshielded.
 - 4. PVC jacket.
 - 5. Flame Resistance: Comply with NFPA 262.

2.7 CONTROL-CIRCUIT CONDUCTORS

- A. Class 1 Control Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.
- B. Class 2 Control Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.
- C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.

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- D. Class 2 Control Circuits and Class 3 Remote-Control and Signal Circuits That Supply Critical Circuits: Circuit Integrity (CI) cable.
 - 1. Smoke control signaling and control circuits.

2.8 SOURCE QUALITY CONTROL

- A. Factory test balanced twisted pair cables according to TIA-568-C.2.
- B. Cable will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Test cables on receipt at Project site.
 - 1. Test each pair of twisted pair cable for open and short circuits.

3.2 INSTALLATION OF RACEWAYS AND BOXES

- A. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or modified in this Section.
 - 1. Flexible metal conduit shall not be used.
- B. Comply with TIA-569-D for pull-box sizing and length of conduit and number of bends between pull points.
- C. Install manufactured conduit sweeps and long-radius elbows if possible.
- D. Raceway Installation in Equipment Rooms:
 - 1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed, or in the corner of the room if multiple sheets of plywood are installed around perimeter walls of the room.
 - 2. Install cable trays or d-rings to route cables if conduits cannot be located in these positions.
 - 3. Extend conduits to associated equipment.
 - 4. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
 - 1. Comply with TIA-568-C Series of standards.
 - 2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems."
 - 3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.

4. Cables may not be spliced and shall be continuous from terminal to terminal. Do not splice cable between termination, tap, or junction points.
5. Cables serving a common system may be grouped in a common raceway. Install network cabling and control wiring and cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
6. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Install lacing bars and distribution spools.
8. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.
10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Monitor cable pull tensions.
11. Support: Do not allow cables to lay on removable ceiling tiles.
12. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
13. Provide strain relief.
14. Keep runs short. Allow extra length for connecting to terminals. Do not bend cables in a radius less than 10 times the cable OD. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.
15. Ground wire shall be copper, and grounding methods shall comply with IEEE C2. Demonstrate ground resistance.

C. Balanced Twisted Pair Cable Installation:

1. Comply with TIA-568-C.2.
2. Install termination hardware as specified in Section 271513 "Communications Copper Horizontal Cabling" unless otherwise indicated.
3. Do not untwist UTP cables more than 1/2 inch (12 mm) at the point of termination to maintain cable geometry.

D. Installation of Control-Circuit Conductors:

1. Install wiring in raceways. Comply with requirements specified in Section 260533 "Raceways and Boxes for Electrical Systems."

E. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 30 inches (760 mm) apart.
3. Cable shall not be run through or on structural members or in contact with pipes, ducts, or other potentially damaging items. Do not run cables between structural members and corrugated panels.

3.4 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits; No 14 AWG.
2. Class 2 low-energy, remote-control, and signal circuits; No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm, and signal circuits; No 12 AWG.

3.5 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA-569-D, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping" Chapter.

3.6 GROUNDING

- A. For data communication wiring, comply with TIA-607-B and with BICSI TDMM, "Bonding and Grounding (Earthing)" Chapter.
- B. For low-voltage control wiring and cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.7 IDENTIFICATION

- A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Identify data and communications system components, wiring, and cabling according to TIA-606-B; label printers shall use label stocks, laminating adhesives, and inks complying with UL 969.
- C. Identify each wire on each end and at each terminal with a number-coded identification tag. Each wire shall have a unique tag.

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Visually inspect cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA-568-C.1.
 - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
- C. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 260523

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes grounding and bonding systems and equipment.

1.3 QUALITY ASSURANCE

- 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. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- 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. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
 - 6. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.3 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless exothermic-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.4 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet (19 mm by 3 m).

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- C. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING SEPARATELY DERIVED SYSTEMS

- A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

3.4 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- E. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.
- F. Metallic Fences: Comply with requirements of IEEE C2.
 - 1. Grounding Conductor: Bare copper, not less than No. 8 AWG.
 - 2. Gates: Shall be bonded to the grounding conductor with a flexible bonding jumper.
 - 3. Barbed Wire: Strands shall be bonded to the grounding conductor.

3.5 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- D. Grounding and Bonding for Piping:

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1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.
- F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.
- G. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG.
1. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.
 2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
- B. Related Sections include the following:
 - 1. Section 260548 "Vibration and Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.4 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

1.5 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 2. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel or Aluminum, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 - 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - 6. Toggle Bolts: All-steel springhead type.
 - 7. Hanger Rods: Threaded steel or Aluminum.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with single-bolt conduit clamps or single-bolt conduit clamps using spring friction action for retention in support channel.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
 - 6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts or Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 - 7. To Light Steel: Sheet metal screws.
 - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

END OF SECTION 260529

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SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Boxes, enclosures, and cabinets.
5. Handholes and boxes for exterior underground cabling.

B. Related Requirements:

1. Section 270528 "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.
2. Section 280528 "Pathways for Electronic Safety and Security" for conduits, surface pathways, innerduct, boxes, and faceplate adapters serving electronic safety and security.

1.3 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

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- B. GRC: Comply with ANSI C80.1 and UL 6.
- C. ARC: Comply with ANSI C80.5 and UL 6A.
- D. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
 - 1. Comply with NEMA RN 1.
 - 2. Coating Thickness: 0.040 inch (1 mm), minimum.
- E. EMT: Comply with ANSI C80.3 and UL 797.
- F. FMC: Comply with UL 1; zinc-coated steel or aluminum.
- G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 - 2. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: Setscrew or compression.
 - 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
 - 4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
- I. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- C. Continuous HDPE: Comply with UL 651B.
- D. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- E. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1, Type 3R, Type 4, or Type 12 unless otherwise indicated, and sized according to NFPA 70.

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1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- C. Wireway Covers: Flanged-and-gasketed type unless otherwise indicated.
- D. Finish: Manufacturer's standard enamel finish.

2.4 SURFACE RACEWAYS

- A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hubbell Incorporated.
 - b. Wiremold / Legrand.

2.5 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- D. Metal Floor Boxes:
 1. Material: sheet metal.
 2. Type: Fully adjustable.
 3. Shape: Rectangular.
 4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.
- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

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- G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).
- J. Gangable boxes are prohibited.
- K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type as required for installed location with continuous-hinge cover with flush latch unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- L. Cabinets:
 - 1. NEMA 250, Type as required for installed location galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - 2. Hinged door in front cover with flush latch and concealed hinge.
 - 3. Key latch to match panelboards.
 - 4. Metal barriers to separate wiring of different systems and voltage.
 - 5. Accessory feet where required for freestanding equipment.
 - 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.6 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. General Requirements for Handholes and Boxes:
 - 1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
 - 2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
 - 1. Standard: Comply with SCTE 77.
 - 2. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
 - 3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
 - 4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 - 5. Cover Legend: Molded lettering, "ELECTRIC."
 - 6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
 - 7. Handholes 12 Inches Wide by 24 Inches Long (300 mm Wide by 600 mm Long) and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.7 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 - 1. Tests of materials shall be performed by an independent testing agency.
 - 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 - 3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
 - 1. Aboveground: GRC.
 - 2. Underground Conduit: RNC, Type EPC-40-PVC or Type EPC-80-PVC,.
 - 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 - 4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
 - 1. Exposed, Not Subject to Physical Damage: EMT.
 - 2. Exposed, Not Subject to Physical Damage: EMT.
 - 3. Exposed and Subject to Physical Damage: GRC. Raceway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - d. Garages
 - 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 - 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 - 6. Damp or Wet Locations: GRC.
 - 7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
 - 1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing

conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.

3. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- G. Install surface raceways only where indicated on Drawings.
- H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- I. Raceways Embedded in Slabs:
 1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m) intervals.
 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 3. Arrange raceways to keep a minimum of 2 inches (50 mm) of concrete cover in all directions.
 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
 5. Change from RNC to GRC before rising above floor.

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- J. Stub-ups to Above Recessed Ceilings:
1. Use EMT or RMC for raceways.
 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- L. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- Q. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- S. Surface Raceways:
1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- T. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- U. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 2. Where an underground service raceway enters a building or structure.

3. Where otherwise required by NFPA 70.
- V. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- W. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- X. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations.
- Y. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to top of box unless otherwise indicated.
- Z. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- AA. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- BB. Locate boxes so that cover or plate will not span different building finishes.
- CC. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

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- DD. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- EE. Set metal floor boxes level and flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
5. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.
- D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.
- E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

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3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260548 - VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Isolation pads.
 - 2. Channel support systems.
 - 3. Restraint cables.
 - 4. Hanger rod stiffeners.
 - 5. Anchorage bushings and washers.
- B. Related Sections include the following:
 - 1. Division 26 Section "Hangers And Supports For Electrical Systems" for commonly used electrical supports and installation requirements.

1.3 DEFINITIONS

- A. The IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
 - 1. Site Class as Defined in the IBC: D.
 - 2. Site Class as Defined in the IBC: D.
 - 3. Assigned Seismic Use Group or Building Category as Defined in the IBC: IV.
 - a. Component Importance Factor:
 - 1) General: 1.0.
 - 2) Life Safety (EM): 1.5

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b. Component Response Modification Factor:

- 1) Fixtures: 1.5
- 2) Equipment: 2.5
- 3) Conduit and Cables: 5.0.

c. Component Amplification Factor: 2.5.

4. Design Spectral Response Acceleration at Short Periods (0.2 Second): 173%.
5. Design Spectral Response Acceleration at 1.0-Second Period: 76%.

1.5 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
- D. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SEISMIC-RESTRAINT DEVICES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Amber/Booth Company, Inc.
 2. California Dynamics Corporation.
 3. Cooper B-Line, Inc.; a division of Cooper Industries.
 4. Hilti Inc.
 5. Loos & Co.; Seismic Earthquake Division.
 6. Mason Industries.
 7. TOLCO Incorporated; a brand of NIBCO INC.
 8. Unistrut; Tyco International, Ltd.
- B. General Requirements for Restraint Components: Rated strengths, features, and application requirements shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

- C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
- D. Restraint Cables: ASTM A 603 galvanized or ASTM A 492 stainless-steel cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
- E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or Reinforcing steel angle clamped to hanger rod. Do not weld stiffeners to rods.
- F. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.
- G. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices.
- H. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
- I. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.
- J. Adhesive Anchor: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.2 FACTORY FINISHES

- A. Finish: Manufacturer's standard prime-coat finish ready for field painting.
- B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
 - 1. Powder coating on springs and housings.
 - 2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
 - 3. Baked enamel or powder coat for metal components on isolators for interior use.
 - 4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Equipment and Hanger Restraints:
 - 1. Install restrained isolators on electrical equipment.
 - 2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
 - 3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.
- B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- D. Drilled-in Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 5. Test to 90 percent of rated proof load of device.
 6. Measure isolator restraint clearance.
 7. Measure isolator deflection.
 8. Verify snubber minimum clearances.
 9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Prepare test and inspection reports.

3.6 ADJUSTING

- A. Adjust isolators after isolated equipment is at operating weight.
- B. Adjust active height of spring isolators.
- C. Adjust restraints to permit free movement of equipment within normal mode of operation.

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END OF SECTION 260548

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Identification for conductors.
 - 2. Underground-line warning tape.
 - 3. Warning labels and signs.
 - 4. Instruction signs.
 - 5. Equipment identification labels.
 - 6. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's

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wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
- B. Self-Adhesive, Self-Laminating Polyester Labels: Write-on, 3-mil- (0.08-mm-) thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-resistant, self-laminating, protective shield over the legend. Labels sized to fit the conductor diameter such that the clear shield overlaps the entire printed legend.
- C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.2 FLOOR MARKING TAPE

- A. 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.3 UNDERGROUND-LINE WARNING TAPE

- A. Tape:
 - 1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
 - 2. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - 3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
- B. Color and Printing:
 - 1. Comply with ANSI Z535.1 through ANSI Z535.5.
 - 2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE,.
 - 3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE,.

2.4 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.

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- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- C. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."
 - 2. Arc Flash Hazard Warning: Manufacturer's standard.

2.5 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.
 - 1. Engraved legend with black letters on white face.
 - 2. Punched or drilled for mechanical fasteners.

2.6 EQUIPMENT IDENTIFICATION LABELS

- A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).
- B. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

2.7 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch (5 mm).
 - 2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
 - 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 - 4. Color: Black except where used for color-coding.
- B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch (5 mm).
 - 2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
 - 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 - 4. Color: Black.
- C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.
 - 1. Minimum Width: 3/16 inch (5 mm).
 - 2. Tensile Strength at 73 deg F ((23 deg C)), According to ASTM D 638: 7000 psi (48.2 MPa).
 - 3. UL 94 Flame Rating: 94V-0.

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4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
5. Color: Black.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape with adhesive appropriate to the location and substrate.
- G. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- I. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
 1. Outdoors: UV-stabilized nylon.
 2. In Spaces Handling Environmental Air: Plenum rated.
- J. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches (400 mm) overall.

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- K. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. Emergency Power.
 - 2. Power.
 - 3. UPS.
- B. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 - 1. Color-Coding for Phase Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - 4) Neutral: White with colored stripe to match associated phase
 - 5) Ground: Green
 - c. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- C. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive vinyl labels with the conductor or cable designation, origin, and destination.
- D. Control-Circuit Conductor Termination Identification: For identification at terminations provide self-adhesive vinyl labels with the conductor designation.
- E. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

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- G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
 - 1. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- H. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
 - 1. Comply with 29 CFR 1910.145.
 - 2. Identify system voltage with black letters on an orange background.
 - 3. Apply to exterior of door, cover, or other access.
- J. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- K. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
 - 1. Labeling Instructions:
 - a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
 - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
 - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
 - 2. Equipment to Be Labeled:
 - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic or melamine label.
 - b. Enclosures and electrical cabinets.
 - c. Access doors and panels for concealed electrical items.
 - d. Enclosed switches.
 - e. Enclosed circuit breakers.
 - f. Enclosed controllers.
 - g. Push-button stations.
 - h. Contactors.
 - i. Remote-controlled switches, dimmer modules, and control devices.
 - j. UPS equipment.

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END OF SECTION 260553

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SECTION 260923 - LIGHTING CONTROL DEVICES

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. Photoelectric switches.
2. Standalone daylight-harvesting switching controls.
3. Indoor occupancy sensors.

- B. Related Requirements:

1. Section 262726 "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Shop Drawings: Show installation details for occupancy and light-level sensors.

1. Interconnection diagrams showing field-installed wiring.
2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

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1. Lithonia Lighting; Acuity Brands Lighting, Inc.: N-Light system

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lux), with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of the photocell to prevent fixed light sources from causing turn-off.
 3. Time Delay: Fifteen second minimum, to prevent false operation.
 4. Surge Protection: Metal-oxide varistor.
 5. Mounting: Twist lock complies with NEMA C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

2.3 DAYLIGHT-HARVESTING DIMMING CONTROLS

- A. System Description: Sensing daylight and electrical lighting levels, the system adjusts the indoor electrical lighting levels. As daylight increases, the lights are dimmed.
1. Lighting control set point is based on two lighting conditions:
 - a. When no daylight is present (target level).
 - b. When significant daylight is present.
 2. System programming is done with two hand-held, remote-control tools.
 - a. Initial setup tool.
 - b. Tool for occupants to adjust the target levels by increasing the set point up to 25 percent, or by minimizing the electric lighting level.
- B. Ceiling-Mounted Dimming Controls: Solid-state, light-level sensor unit, with separate controller unit, to detect changes in lighting levels that are perceived by the eye.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Sensor Output: 0- to 10-V dc to operate electronic dimming ballasts. Sensor is powered by controller unit.
 3. Power Pack: Sensor has 24-V dc, Class 2 power source, as defined by NFPA 70.
 4. Light-Level Sensor Set-Point Adjustment Range: 20 to 60 fc (120 to 640 lux).

2.4 INDOOR OCCUPANCY SENSORS

- A. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.

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1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
5. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
7. Bypass Switch: Override the "on" function in case of sensor failure.
8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux); turn lights off when selected lighting level is present.

B. PIR Type: Ceiling mounted; detect occupants in coverage area by their heat and movement.

1. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm).
2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
3. Detection Coverage (Corridor): Detect occupancy within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling.

C. Ultrasonic Type: Ceiling mounted; detect occupants in coverage area through pattern changes of reflected ultrasonic energy .

1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. (56 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. (186 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling in a corridor not wider than 14 feet (4.3 m).

D. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving not less than 12 inches (305 mm)

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in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).

3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.

2.5 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

- A. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.
 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F (0 to 49 deg C).
 3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.

2.6 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 22 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 16 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 WIRING INSTALLATION

- A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch (13 mm).
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

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- C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

- A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."
 - 1. Identify controlled circuits in lighting contactors.
 - 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Lighting control devices will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
 - 1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
 - 2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.

3.6 DEMONSTRATION

- A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control systems specified in Section 260943.13 "Addressable-Fixture Lighting Controls" and Section 260943.23 "Relay-Based Lighting Controls."
- B. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION 260923

SECTION 260943 - RELAY-BASED LIGHTING CONTROLS

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: Networked lighting control panels using control-voltage relays for switching.

1.3 DEFINITIONS

- A. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.
- B. PC: Personal computer; sometimes plural as "PCs."
- C. RS-485: A serial network protocol, similar to RS-232, complying with TIA-485-A.

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 control modules, power distribution components, relays, manual switches and plates, and conductors and cables.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For each relay panel and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail wiring partition configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of relays.
 - 5. Include diagrams for power, signal, and control wiring.
 - 6. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in other Sections.
 - 1. Show interconnecting signal and control wiring, and interface devices that prove compatibility of inputs and outputs.
 - 2. For networked controls, list network protocols and provide statements from manufacturers that input and output devices comply with interoperability requirements of the network protocol.
- B. Software licenses and upgrades required by and installed for operation and programming of digital and analog devices.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lighting controls to include in emergency, operation, and maintenance manuals.
- B. Software and Firmware Operational Documentation:
 - 1. Software operating and upgrade manuals.
 - 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
 - 3. Device address list.
 - 4. Printout of software application and graphic screens.

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. Lighting Control Relays: Equal to ten percent of amount installed for each size indicated, but no fewer than three.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Handle and prepare panels for installation according to NECA 407.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Input signal from field-mounted manual switches, or digital signal sources, shall open or close one or more lighting control relays in the lighting control panels. Any combination of inputs shall be programmable to any number of control relays.
- B. 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.
- C. Comply with 47 CFR, Subparts A and B, for Class A digital devices.
- D. Comply with UL 916.

2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Lighting control panels shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified."
 - 2. Component Importance Factor: 1.5.

2.3 NETWORKED LIGHTING CONTROL PANELS

- A. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Lithonia N-Light
- B. Description: Lighting control panels using mechanically latched relays to control lighting and appliances. The panels shall be capable of being interconnected with digital communications to appear to the operator as a single lighting control system.
- C. Lighting Control Panels:
 - 1. A single enclosure with incoming lighting branch circuits, control circuits, switching relays, and on-board timing and control unit.
 - 2. A vertical barrier separating branch circuits from control wiring.
- D. Main Control Unit: Installed in the main lighting control panel only; powered from the branch circuit of the standard control unit.
 - 1. Ethernet Communications: Comply with MS Windows TCP/IP protocol. The main control unit shall provide for programming of all control functions of the main and all networked slave lighting control panels including timing, sequencing, and overriding.
 - 2. Compliance with ASHRAE 135: Controllers shall support serial MS/TP and Ethernet IP communications, and shall be able to communicate directly via BAS RS-485 serial networks and Ethernet 10Base-T networks as a native device.
 - 3. Web Server: Display information listed below over a standard Web-enabled server for displaying information over a standard browser.
 - a. A secure, password-protected login screen for modifying operational parameters, accessible to authorized users via Web page interface.
 - b. Panel summary showing the master and slave panels connected to the controller.
 - c. Controller diagnostic information.
 - d. Show front panel mimic screens for setting up controller parameters, input types, zones, and operating schedules. These mimic screens shall also allow direct breaker control and zone overrides.
 - 4. Timing Unit:
 - a. 365-day calendar, astronomical clock, and automatic adjustments for daylight savings and leap year.
 - b. Clock configurable for 12-hour (A.M./P.M.) or 24-hour format.
 - c. Four independent schedules, each having 24 time periods.
 - d. Schedule periods settable to the minute.
 - e. Day-of-week, day-of-month, day-of-year with one-time or repeating capability.
 - f. 16 special date periods.
 - 5. Time Synchronization: The timing unit shall be updated not less than every hour(s) with the network time server.
 - 6. Sequencing Control with Override:
 - a. Automatic sequenced on and off switching of selected relays at times set at the timing unit, allowing timed overrides from external switches.
 - b. Sequencing control shall operate relays one at a time, completing the operation of all connected relays in not more than 10 seconds.

- c. Override control shall allow any relay connected to it to be switched on or off by a field-deployed manual switch or by an automatic switch, such as an occupancy sensor.
 - d. Override control "blinking warning" shall warn occupants approximately five minutes before actuating the off sequence.
 - e. Activity log, storing previous relay operation, including the time and cause of the change of status.
 - f. Download firmware to the latest version offered by manufacturer.
- E. Standard Control Unit, Installed in All Lighting Control Panels: Contain electronic controls for programming the operation of the relays in the control panel, contain the status of relays, and contain communications link to enable the digital functions of the main control unit. Comply with UL 916.
 - 1. Electronic control for operating and monitoring individual relays, and display relay on-time.
 - 2. Nonvolatile memory shall retain all setup configurations. After a power failure, the controller shall automatically reboot and return to normal system operation.
- F. Operator Interface:
 - 1. Integral touchscreen keypad and digital display, and intuitive menus to assist in programming.
 - 2. Log and display relay on-time.
 - 3. Connect relays to one or more time and sequencing schemes.
 - 4. Blink notice, time adjustable from software.
 - 5. Ability to log and display relay on-time.
 - 6. Capability for accepting downloadable firmware so that the latest production features may be added in the future without replacing the module.
- G. Relays: Electrically operated, mechanically held single-pole switch, rated at 20 A at 120-V tungsten, 30 A at 277-V ballast, 1.5 hp at 120 V, and 3 hp at 277 V. Short-circuit current rating shall be not less than 14 kA. Control shall be digital control network.
- H. Power Supply: NFPA 70, Class 2, UL listed, sized for connected equipment, plus not less than 20 percent spare capacity. Powered from a dedicated branch circuit of the panelboard that supplies power to the line side of the relays, sized to provide control power for the local panel-mounted relays, bus system, low-voltage inputs, field-installed occupancy sensors, and low-voltage photo sensors.
- I. Operator Interface: At the main control unit, provide interface for a tethered connection of a portable PC running MS Windows for configuring all networked lighting control panels using setup software designed for the specified operating system. Include one portable device for initial programming of the system and training of Owner's personnel. That device shall remain the property of Owner.
- J. Software:
 - 1. Menu-driven data entry.
 - 2. Online and offline programming and editing.
 - 3. Provide for entry of the room or space designation for the load side of each relay.
 - 4. Monitor and control all relays, showing actual relay state and the name of the automatic actuating control, if any.
 - 5. Size the software appropriate to the system.

2.4 MANUAL SWITCHES AND PLATES

- A. Push-Button Switches: Modular, digital type communicating with control panel over digital bus.
 - 1. Match color specified in Division 26 Section "Wiring Devices."
 - 2. Integral green LED pilot light to indicate when circuit is on.
 - 3. Internal white LED locator light to illuminate when circuit is off.
 - 4. Manufacturers: Compatible with control systems specified. Examples of acceptable switches include, but are not limited to:
 - a. Cooper Greengate: Digita series
 - b. Leviton: Z-MAX series
 - c. LC&D: Chelsea DigitalSwitch
 - 5. Integral green LED pilot light to indicate when circuit is on.
 - 6. Internal white LED locator light to illuminate when circuit is off.
- B. Wall Plates: Single and multigang plates as specified in Section 262726 "Wiring Devices."
- C. Legend: Engraved or permanently silk-screened on wall plate where indicated. Use designations indicated on Drawings.

2.5 FIELD-MOUNTED SIGNAL SOURCES

- A. Daylight Harvesting Switching Controls: Comply with Section 260923 "Lighting Control Devices." Control power may be taken from the lighting control panel, and signal shall be compatible with the relays.
- B. Indoor Occupancy Sensors: Comply with Section 260923 "Lighting Control Devices." Control power may be taken from the lighting control panel, and signal shall be compatible with the relays.

2.6 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cables: Multiconductor cable with copper conductors not smaller than No. 22 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cables: Multiconductor cable with copper conductors not smaller than No. 16 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- D. Digital and Multiplexed Signal Cables: Unshielded, twisted-pair cable with copper conductors, complying with TIA/EIA-568-B.2, Category 5e for horizontal copper cable and with Section 271500 "Communications Horizontal Cabling."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Receive, inspect, handle, and store panels according to NECA 407.

- B. Examine panels before installation. Reject panels that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panels for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 WIRING INSTALLATION

- A. Comply with NECA 1.
- B. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Comply with requirements for cable trays specified in Section 260536 "Cable Trays for Electrical Systems."
 - 3. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- C. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.3 PANEL INSTALLATION

- A. Comply with NECA 1.
- B. Install panels and accessories according to NECA 407.
- C. Comply with mounting and anchoring requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- D. Mount panel cabinet plumb and rigid without distortion of box.
- E. Install filler plates in unused spaces.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."

- C. Create a directory to indicate loads served by each relay; incorporate Owner's final room designations. Obtain approval before installing. Use a PC or typewriter to create directory; handwritten directories are unacceptable.
- D. Lighting Control Panel Nameplates: Label each panel with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Acceptance Testing Preparation:
 - 1. Test continuity of each circuit.
- D. Lighting control panel will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies lighting control panels and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.6 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Confirm correct communications wiring, initiate communications between panels, and program the lighting control system according to approved configuration schedules, time-of-day schedules, and input override assignments.

3.7 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.8 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.
- B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

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1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the control unit and operator interface.

END OF SECTION 260943

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SECTION 262416 - PANELBOARDS

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. Distribution panelboards.
 - 2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

- A. SPD: Surge Protective Device

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 5. Include evidence of NRTL listing for series rating of installed devices.
 - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 7. Include wiring diagrams for power, signal, and control wiring.
 - 8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems." Include the following:

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1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

C. Panelboard Schedules: For installation in panelboards.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

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. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.

1.8 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. 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.

D. Comply with NEMA PB 1.

E. Comply with NFPA 70.

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1.9 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations:
 - 1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards 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.
 - 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding 23 deg F (minus 5 deg C) to plus 104 deg F (plus 40 deg C).
 - b. Altitude: Not exceeding 6600 feet (2000 m).
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
 - 1. Ambient temperatures within limits specified.
 - 2. Altitude not exceeding 6600 feet (2000 m).

1.11 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Square D; a brand of Schneider Electric.
- B. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."

- C. Enclosures: Flush- and surface-mounted cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - b. Outdoor Locations: NEMA 250, Type 3R.
 - c. Wash-Down Areas: NEMA 250, Type 4X,.
 - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
 - 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 - 3. Finishes:
 - a. Panels and Trim: galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Back Boxes: Galvanized steel.
 - 4. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.
- D. Phase, Neutral, and Ground Buses:
 - 1. Material: Tin-plated aluminum or Hard-drawn copper, 98 percent conductivity.
 - 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
 - 3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
- E. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Material: Tin-plated aluminum or Hard-drawn copper, 98 percent conductivity.
 - 2. Main and Neutral Lugs: Mechanical type.
 - 3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
 - 4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 - 5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
- F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.
- G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- H. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

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1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
- B. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 1.

2.3 DISTRIBUTION PANELBOARDS

- A. Panelboards: NEMA PB 1, power and feeder distribution type.
- B. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
 1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.
- C. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- B. Mains: Circuit breaker or lugs only.
- C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 2. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 3. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
 4. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.

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- d. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
- e. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.

2.6 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Equipment Mounting: Install panelboards on concrete bases, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.
 - 2. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to panelboards.
 - 5. Attach panelboard to the vertical finished or structural surface behind the panelboard.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- D. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."

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- E. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.
- F. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- G. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
- H. Install filler plates in unused spaces.
- I. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.
- J. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- K. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 ADJUSTING

- A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as indicated

END OF SECTION 262416

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SECTION 262726 - WIRING DEVICES

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. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Twist-locking receptacles.
 - 3. Isolated-ground receptacles.
 - 4. Weather-resistant receptacles.
 - 5. Snap switches and wall-box dimmers.
 - 6. Pendant cord-connector devices.
 - 7. Cord and plug sets.
 - 8. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.
- F. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 2. Cord and Plug Sets: Match equipment requirements.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.

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- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.

1.6 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
 - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 3. Leviton Mfg. Company Inc. (Leviton).
 - 4. Pass & Seymour/Legrand (Pass & Seymour).
- B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
 - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
 - 2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
- B. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

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1. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.4 GFCI RECEPTACLES

A. General Description:

1. Straight blade, feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

C. Tamper-Resistant GFCI Convenience Receptacles, 125 V, 20 A:

2.5 TWIST-LOCKING RECEPTACLES

- #### A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.

2.6 PENDANT CORD-CONNECTOR DEVICES

A. Description:

1. Matching, locking-type plug and receptacle body connector.
2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.7 CORD AND PLUG SETS

A. Description:

1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.8 TOGGLE SWITCHES

- #### A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

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B. Switches, 120/277 V, 20 A:

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

a. Single Pole:

- 1) Cooper; AH1221.
- 2) Hubbell; HBL1221.
- 3) Leviton; 1221-2.
- 4) Pass & Seymour; CSB20AC1.

b. Two Pole:

- 1) Cooper; AH1222.
- 2) Hubbell; HBL1222.
- 3) Leviton; 1222-2.
- 4) Pass & Seymour; CSB20AC2.

c. Three Way:

- 1) Cooper; AH1223.
- 2) Hubbell; HBL1223.
- 3) Leviton; 1223-2.
- 4) Pass & Seymour; CSB20AC3.

d. Four Way:

- 1) Cooper; AH1224.
- 2) Hubbell; HBL1224.
- 3) Leviton; 1224-2.
- 4) Pass & Seymour; CSB20AC4.

C. Pilot-Light Switches, 20 A:

1. Description: Single pole, with neon-lighted handle, illuminated when switch is "off."

2.9 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable toggle switch; with single-pole or three-way switching. Comply with UL 1472.
- C. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.
- D. LED Lamp Dimmer Switches: Modular; compatible with dimming drivers; trim potentiometer to adjust low-end dimming; dimmer-driver combination capable of consistent dimming with low end not greater than 5 percent of full brightness.

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2.10 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
 - 3. Material for Unfinished Spaces: Galvanized steel.
 - 4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum or thermoplastic with lockable cover.

2.11 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: Rectangular, with satin finish.
- D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.
- E. Voice and Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 jacks for UTP cable complying with requirements in Section 271500 "Communications Horizontal Cabling."

2.12 FINISHES

- A. Device Color:
 - 1. Wiring Devices Connected to Normal Power System: White or As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
 - 2. Isolated-Ground Receptacles: Orange.
- B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
 - 1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.

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3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the left.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

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- I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

- A. Install feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

- A. Comply with Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 1. Test Instruments: Use instruments that comply with UL 1436.
 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- B. Tests for Convenience Receptacles:
 1. Line Voltage: Acceptable range is 105 to 132 V.
 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- C. Wiring device will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 262726

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

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:
 - 1. Nonfusible switches.
 - 2. Molded-case circuit breakers (MCCBs).
 - 3. Enclosures.

1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.4 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 - 4. Include evidence of NRTL listing for series rating of installed devices.
 - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
 - 6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

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- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Wiring Diagrams: For power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- B. Field quality-control reports.
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 - 2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.8 QUALITY ASSURANCE

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. 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.
- D. Comply with NFPA 70.

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1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - 1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
 - 2. Altitude: Not exceeding 6600 feet (2010 m).

1.10 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Square D; by Schneider Electric.

2.2 NONFUSIBLE SWITCHES

- A. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- B. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 4. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
 - 5. Hookstick Handle: Allows use of a hookstick to operate the handle.
 - 6. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.3 MOLDED-CASE CIRCUIT BREAKERS

- A. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

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- B. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- C. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- D. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).
- E. Features and Accessories:
 - 1. Standard frame sizes, trip ratings, and number of poles.
 - 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
 - 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.

2.4 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
 - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Outdoor Locations: NEMA 250, Type 3R.
 - 3. Wash-Down Areas: NEMA 250, Type 4X,.
 - 4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
 - 5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
 - 6. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

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- D. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 262816

SECTION 262913 - ENCLOSED CONTROLLERS

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 the following enclosed controllers rated 600 V and less:
 - 1. Full-voltage manual.
 - 2. Full-voltage magnetic.

1.3 DEFINITIONS

- A. CPT: Control power transformer.
- B. MCCB: Molded-case circuit breaker.
- C. MCP: Motor circuit protector.
- D. N.C.: Normally closed.
- E. N.O.: Normally open.
- F. OCPD: Overcurrent protective device.
- G. SCR: Silicon-controlled rectifier.

1.4 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed controllers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed controller. Include manufacturer's technical data on features, performance, electrical characteristics, ratings, and enclosure types and finishes.
- B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.

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1. Show tabulations of the following:
 - a. Each installed unit's type and details.
 - b. Factory-installed devices.
 - c. Nameplate legends.
 - d. Short-circuit current rating of integrated unit.
 - e. Listed and labeled for integrated short-circuit current (withstand) rating of OCPDs in combination controllers by an NRTL acceptable to authorities having jurisdiction.
 - f. Features, characteristics, ratings, and factory settings of individual OCPDs in combination controllers.
2. Wiring Diagrams: For power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For enclosed controllers, accessories, and components, from manufacturer.
 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- B. Field quality-control reports.
- C. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor running overload protection suit actual motors to be protected.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 1. Routine maintenance requirements for enclosed controllers and installed components.
 2. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
 3. Manufacturer's written instructions for setting field-adjustable overload relays.
 4. Manufacturer's written instructions for testing, adjusting, and reprogramming reduced-voltage solid-state controllers.

1.8 QUALITY ASSURANCE

- 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. Comply with NFPA 70.

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- C. IEEE Compliance: Fabricate and test enclosed controllers according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - 1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
 - 2. Altitude: Not exceeding 6600 feet (2010 m).

1.11 COORDINATION

- A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
- C. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Square D; by Schneider Electric.

2.2 FULL-VOLTAGE CONTROLLERS

- A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.
- B. Motor-Starting Switches: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on.
 - 1. Configuration: Nonreversing.
 - 2. Flush or Surface mounting.

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3. Green pilot light.
- C. Fractional Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.
1. Configuration: Nonreversing.
 2. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; bimetallic type or melting alloy type.
 3. Flush or Surface mounting.
 4. Green pilot light.
- D. Magnetic Controllers: Full voltage, across the line, electrically held.
1. Configuration: Nonreversing.
 2. Contactor Coils: Pressure-encapsulated type.
 - a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
 3. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
 4. Control Circuits: As required.
 5. Solid-State Overload Relay:
 - a. Switch or dial selectable for motor running overload protection.
 - b. Sensors in each phase.
 - c. Class 10/20 selectable tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
 - d. Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
 - e. Analog communication module.
 6. N.C./N.O., isolated overload alarm contact.
 7. External overload reset push button.
- E. Combination Magnetic Controller: Factory-assembled combination of magnetic controller, OCPD, and disconnecting means.
1. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.
 2. Nonfusible Disconnecting Means:
 - a. NEMA KS 1, heavy-duty, horsepower-rated, nonfusible switch.
 - b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - c. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.
 3. MCP Disconnecting Means:
 - a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
 - b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - c. Auxiliary contacts "a" and "b" arranged to activate with MCP handle.

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- d. N.C./N.O. alarm contact that operates only when MCP has tripped.
 - e. Current-limiting module to increase controller short-circuit current (withstand) rating to 100 kA.
4. MCCB Disconnecting Means:
- a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
 - b. Front-mounted, adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - c. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - d. Auxiliary contacts "a" and "b" arranged to activate with MCCB handle.
 - e. N.C./N.O. alarm contact that operates only when MCCB has tripped.

2.3 ENCLOSURES

- A. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.
- 1. Dry and Clean Indoor Locations: Type 1.
 - 2. Outdoor Locations: Type 3R.
 - 3. Wash-Down Areas: Type 4X.
 - 4. Other Wet or Damp Indoor Locations: Type 4.
 - 5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: Type 12.
 - 6. Hazardous Areas Indicated on Drawings: Type 7.

2.4 ACCESSORIES

- A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.
- 1. Push Buttons, Pilot Lights, and Selector Switches: Heavy-duty, oiltight type.
 - a. Push Buttons: Shrouded types; momentary as indicated.
 - b. Pilot Lights: LED types; colors as indicated; push to test.
 - c. Selector Switches: Rotary type.
 - 2. Meters: Panel type, 2-1/2-inch (64-mm) minimum size with 90- or 120-degree scale and plus or minus two percent accuracy. Where indicated, provide selector switches with an off position.
- B. Reversible N.C./N.O. auxiliary contact(s).
- C. Breather and drain assemblies, to maintain interior pressure and release condensation in Type 4 Type 4X, and/or Type 7 enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.
- D. Cover gaskets for Type 1 enclosures.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and surfaces to receive enclosed controllers, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."
- B. Floor-Mounted Controllers: Install enclosed controllers on 4-inch (100-mm) nominal-thickness concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
- C. Seismic Bracing: Comply with requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- E. Install heaters in thermal overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.
- F. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.
- G. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

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1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved nameplate.
3. Label each enclosure-mounted control and pilot device.

3.4 CONTROL WIRING INSTALLATION

- A. Install wiring between enclosed controllers and remote devices. Comply with requirements in Section 260523 "Control-Voltage Electrical Power Cables."
- B. Bundle, train, and support wiring in enclosures.
- C. Connect selector switches and other automatic-control selection devices where applicable.
 1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.
 2. Connect selector switches with enclosed-controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.5 ADJUSTING

- A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.
- B. Adjust overload-relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.
- C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Owner before increasing settings.

3.6 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers.

END OF SECTION 262913

SECTION 265100 - INTERIOR LIGHTING

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 lighting fixtures, lamps, and ballasts.
2. Exit signs.
3. Lighting fixture supports.

B. Related Sections:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Section 262726 "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

1.3 DEFINITIONS

- A. BF: Ballast factor.
- B. CCT: Correlated color temperature.
- C. CRI: Color-rendering index.
- D. LER: Luminaire efficacy rating.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
 1. Physical description of lighting fixture including dimensions.
 2. Emergency lighting units including battery and charger.
 3. Ballast, including BF.
 4. Energy-efficiency data.
 5. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.

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6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

- B. Shop Drawings: For nonstandard or custom lighting fixtures. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

- C. Installation instructions.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.
- B. Field quality-control reports.
- C. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
 1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

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. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
 2. Plastic Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
 3. Ballasts: One for every 100 of each type and rating installed. Furnish at least one of each type.
 4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

- 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. Comply with NFPA 70.

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- C. FM Global Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

1.9 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
- C. LED Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE5 and NEMA LE5A as applicable
- D. Metal Parts: Free of burrs and sharp corners and edges.
- E. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
- F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- G. Diffusers and Globes:
 - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
 - b. UV stabilized.
 - 2. Glass: Annealed crystal glass unless otherwise indicated.
- H. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
 - 1. Label shall include the following lamp and ballast characteristics:

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- a. "USE ONLY" and include specific lamp type.
- b. Lamp diameter code (T-4, T-5, T-8, T-12, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
- c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
- d. Start type (preheat, rapid start, instant start, etc.) for fluorescent and compact fluorescent luminaires.
- e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
- f. CCT and CRI for all luminaires.

2.3 EMERGENCY POWER UNIT

- A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast or driver. Comply with UL 924.
 1. Emergency Connection: Operate one lamp(s) continuously at an output of 1300 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
 2. Nightlight Connection: Operate one fluorescent lamp continuously.
 3. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 4. Battery: Sealed, maintenance-free, nickel-cadmium type.
 5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
 6. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
 7. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.4 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
 1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
 2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - b. Charger: Fully automatic, solid-state type with sealed transfer relay.

- c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
- d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
- e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
- f. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is announced by an integral audible alarm and a flashing red LED.

2.5 LED LUMINAIRES

A. Solid State Drivers and LED: Comply with DOE LM 79

- 1. Total Harmonic Distortion Rating: Less than 10 percent
- 2. Transient Voltage protection
- 3. Power factor: 0.90 or higher
- 4. Temperatures: Minus 40 deg F (minus 40 deg C) and higher
- 5. Heat sink to remove heat from circuits
- 6. L70 compliant to 70,000 hours minimum
- 7. Color Rendering Index: 80 CRI minimum
- 8. Dimmable
 - a. Dimming Range: 100 to 1 percent of rated lamp lumens
 - b. Input watts: Can be reduced to 20 percent of normal
 - c. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

2.6 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Section 260529 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).
- C. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage (2.68 mm).
- D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lighting fixtures:

1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
 2. Install lamps in each luminaire.
- B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.
- C. Remote Mounting of Drivers and Ballasts: Distance between the ballast and fixture shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.
- D. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.
1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches (150 mm) from lighting fixture corners.
 2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
 3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
 4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.
- E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 IDENTIFICATION

- A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to backup and retransfer to normal.
- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.4 STARTUP SERVICE

- A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage.

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3.5 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.

- 1. Adjust aimable luminaires in the presence of Architect.

END OF SECTION 265100

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DIVISION 27 - COMMUNICATIONS

270526	GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS
270528	PATHWAYS FOR COMMUNICATIONS SYSTEMS
270536	CABLE TRAYS FOR COMMUNICATIONS SYSTEMS
270553	IDENTIFICATION FOR COMMUNICATIONS SYSTEMS
271513	COMMUNICATIONS COPPER HORIZONTAL CABLING
271533	COMMUNICATIONS COAXIAL HORIZONTAL CABLING

END OF TABLE OF CONTENTS

SECTION 270526 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Grounding conductors.
 - 2. Grounding connectors.
 - 3. Grounding busbars.

1.3 DEFINITIONS

- A. BCT: Bonding conductor for telecommunications.
- B. EMT: Electrical metallic tubing.
- C. TGB: Telecommunications grounding busbar.
- D. TMGB: Telecommunications main grounding busbar.

1.4 INFORMATIONAL SUBMITTALS

- A. As-Built Data: Plans showing as-built locations of grounding and bonding infrastructure, including the following:
 - 1. Ground rods.
 - 2. Ground and roof rings.
 - 3. BCT, TMGB, TGBs, and routing of their bonding conductors.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - 1. Installation Supervision: Installation shall be under the direct supervision of ITS Technician, who shall be present at all times when Work of this Section is performed at Project site.

PART 2 - PRODUCTS

2.1 SYSTEM COMPONENTS

- A. Comply with J-STD-607-A.

2.2 CONDUCTORS

- A. Comply with UL 486A-486B.
- B. Insulated Conductors: Stranded copper wire, green or green with yellow stripe insulation, insulated for 600 V, and complying with UL 83.
 - 1. Ground wire for custom-length equipment ground jumpers shall be No. 6 AWG, 19-strand, UL-listed, Type THHN wire.
 - 2. Cable Tray Equipment Grounding Wire: No. 6 AWG.
- C. Cable Tray Grounding Jumper:
 - 1. Not smaller than No. 6 AWG 26 kcmils (13.3 sq. mm) and not longer than 12 inches (300 mm). If jumper is a wire, it shall have a crimped grounding lug with two holes and long barrel for two crimps. If jumper is a flexible braid, it shall have a one-hole ferrule. Attach with grounding screw or connector provided by cable tray manufacturer.
- D. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 14.2 sq. mm (28 kcmils), 14 strands of No. 17 AWG conductor, and 6.3 mm (1/4 inch) in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Tinned-copper tape, braided conductors terminated with two-hole copper ferrules; 41 mm (1-5/8 inches) wide and 1.6 mm (1/16 inch) thick.

2.3 CONNECTORS

- A. Irreversible connectors listed for the purpose. Listed by an NRTL as complying with NFPA 70 for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 486A-486B.
- B. Compression Wire Connectors: Crimp-and-compress connectors that bond to the conductor when the connector is compressed around the conductor. Comply with UL 467.
 - 1. Electroplated tinned copper, C and H shaped.
- C. Signal Reference Grid Connectors: Combination of compression wire connectors, access floor grounding clamps, bronze U-bolt grounding clamps, and copper split-bolt connectors, designed for the purpose.

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2.4 GROUNDING BUSBARS

- A. TGB: Predrilled rectangular bars of hard-drawn solid copper, 6.3 by 50 mm (1/4 by 2 inches) in cross section, length as indicated on Drawings. The busbar shall be for wall mounting, shall be NRTL listed as complying with UL 467, and shall comply with J-STD-607-A.
 - 1. Predrilling shall be with holes for use with lugs specified in this Section.
 - 2. Mounting Hardware: Stand-off brackets that provide at least a 50-mm (2-inch) clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.)
 - 3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the ac grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of the electrical system.
- B. Inspect the test results of the ac grounding system measured at the point of BCT connection.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with connection of the BCT only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Bonding shall include the ac utility power service entrance, the communications cable entrance, and the grounding electrode system. The bonding of these elements shall form a loop so that each element is connected to at least two others.
- B. Comply with NECA 1.
- C. Comply with J-STD-607-A.

3.3 APPLICATION

- A. Conductors: Install solid conductor for No. 8 AWG and smaller and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
 - 1. The bonding conductors between the TGB and structural steel of steel-frame buildings shall not be smaller than No. 6 AWG.
 - 2. The bonding conductors between the TMGB and structural steel of steel-frame buildings shall not be smaller than No. 6 AWG.
- B. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

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2. Underground Connections: Welded connectors except at ground rods and as otherwise indicated.
3. Connections to Ground Rods: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

C. Conductor Support:

1. Secure grounding and bonding conductors at intervals of not less than 900 mm (36 inches.)

D. Grounding and Bonding Conductors:

1. Install in the straightest and shortest route between the origination and termination point, and no longer than required. The bend radius shall not be smaller than eight times the diameter of the conductor. No one bend may exceed 90 degrees.
2. Install without splices.
3. Support at not more than 900-mm (36-inch) intervals.
4. Install grounding and bonding conductors in 21-mm (3/4-inch) PVC conduit until conduit enters a telecommunications room. The grounding and bonding conductor pathway through a plenum shall be in EMT. Conductors shall not be installed in EMT unless otherwise indicated.
 - a. If a grounding and bonding conductor is installed in ferrous metallic conduit, bond the conductor to the conduit using a grounding bushing that complies with requirements in Section 270528 "Pathways for Communications Systems," and bond both ends of the conduit to a TGB.

3.4 GROUNDING ELECTRODE SYSTEM

- A. The BCT between the TMGB and the ac service equipment ground shall not be smaller than No. 4 AWG.

3.5 GROUNDING BUSBARS

- A. Indicate locations of grounding busbars on Drawings. Install busbars horizontally, on insulated spacers 50 mm (2 inches) minimum from wall, 300 mm (12 inches) above finished floor unless otherwise indicated.

3.6 CONNECTIONS

- A. Bond metallic equipment in a telecommunications equipment room to the grounding busbar in that room, using equipment grounding conductors not smaller than No. 6 AWG.
- B. Stacking of conductors under a single bolt is not permitted when connecting to busbars.
- C. Assemble the wire connector to the conductor, complying with manufacturer's written instructions and as follows:
 1. Use crimping tool and the die specific to the connector.
 2. Pretwist the conductor.
 3. Apply an antioxidant compound to all bolted and compression connections.

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- D. Primary Protector: Bond to the TMGB with insulated bonding conductor.
- E. Telecommunications Enclosures and Equipment Racks: Bond metallic components of enclosures to the telecommunications bonding and grounding system. Bond the equipment grounding busbar to the TGB No. 2 AWG bonding conductors.
- F. Structural Steel: Where the structural steel of a steel frame building is readily accessible within the room or space, bond each TGB and TMGB to the vertical steel of the building frame.
- G. Electrical Power Panelboards: Where an electrical panelboard for telecommunications equipment is located in the same room or space, bond each TGB to the ground bar of the panelboard.

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
- C. Excessive Ground Resistance: If resistance to ground at the BCT exceeds 5 ohms, notify Architect promptly and include recommendations to reduce ground resistance.
- D. Grounding system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

END OF SECTION 270526

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SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Metal conduits and fittings.
- 2. Boxes, enclosures, and cabinets.

- B. Related Requirements:

- 1. Section 260533 "Raceways and Boxes for Electrical Systems" for conduits, wireways, surface raceways, boxes, enclosures, cabinets, handholes, and faceplate adapters serving electrical systems.
- 2. Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling" for sealing of penetrations of communications pathways through building elements.

1.3 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

- A. General Requirements for Metal Conduits and Fittings:

- 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- 2. Comply with TIA-569-B.

- B. GRC: Comply with ANSI C80.1 and UL 6.

- C. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

- 1. Comply with NEMA RN 1.
- 2. Coating Thickness: 0.040 inch (1 mm), minimum.

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- D. EMT: Comply with ANSI C80.3 and UL 797.
- E. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Fittings for EMT:
 - a. Material: Steel or die cast.
 - b. Type: Setscrew or compression.
 - 2. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.
 - 3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

2.2 NONMETALLIC CONDUITS AND FITTINGS

- A. General Requirements for Nonmetallic Conduits and Fittings:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Comply with TIA-569-B.
- B. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- C. Rigid HDPE: Comply with UL 651A.
- D. Continuous HDPE: Comply with UL 651B.
- E. RTRC: Comply with UL 1684A and NEMA TC 14.
- F. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

2.3 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets:
 - 1. Comply with TIA-569-B.
 - 2. Boxes, enclosures and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Sheet-Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy or aluminum, Type FD, with gasketed cover.
- D. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- E. Metal Floor Boxes:
 - 1. Material: Cast metal or sheet metal.
 - 2. Type: Fully adjustable.
 - 3. Shape: Rectangular.

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4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum or galvanized, cast iron with gasketed cover.
- H. Device Box Dimensions: 5 inches square by 2-7/8 inches deep.
- I. Gangable boxes are prohibited.

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION

- A. Outdoors: Apply pathway products as specified below unless otherwise indicated:
 1. Aboveground Conduit: GRC.
 2. Underground Conduit: RNC, Type EPC-40-PVC,.
 3. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Indoors: Apply pathway products as specified below unless otherwise indicated:
 1. Exposed, Not Subject to Physical Damage: EMT.
 2. Exposed and Subject to Physical Damage: GRC. Pathway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - d. Vehicle Garages
 3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 4. Damp or Wet Locations: GRC.
 5. Pathways for Optical-Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical-fiber-cable pathway.
 6. Pathways for Concealed General-Purpose Distribution of Optical-Fiber or Communications Cable: EMT.
 7. Boxes and Enclosures: NEMA 250 Type 1, except use NEMA 250 Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Pathway Size: 1 inch (27 mm).
- D. Pathway Fittings: Compatible with pathways and suitable for use and location.
 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.

3. EMT: Use setscrew or compression, steel cast-metal fittings. Comply with NEMA FB 2.10.

3.2 INSTALLATION

- A. Comply with NECA 1, NECA 101, and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
- B. Keep pathways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
- C. Complete pathway installation before starting conductor installation.
- D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches (300 mm) of changes in direction. Utilize long radius ells for all optical-fiber cables.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- I. Pathways Embedded in Slabs:
 1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot (3-m) intervals.
 2. Arrange pathways to cross building expansion joints at right angles with expansion fittings.
 3. Arrange pathways to keep a minimum of 2 inches (50 mm) of concrete cover in all directions.
 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
 5. Change from RNC, Type EPC-40-PVC to GRC before rising above floor.
- J. Stub-ups to Above Recessed Ceilings:
 1. Use EMT, IMC, or RMC for pathways.
 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.
- L. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.

- M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.
- N. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- P. Cut conduit perpendicular to the length. For conduits of 2-inch (53-mm) trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.
- Q. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.
- R. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:
 - 1. 1-Inch (27-mm) Trade Size and Larger: Install pathways in maximum lengths of 75 feet (23 m).
 - 2. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- S. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway sealing fittings according to NFPA 70.
- T. Install devices to seal pathway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service pathway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.
- U. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.
- V. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to top of box unless otherwise indicated.
- W. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- X. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

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- Y. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- Z. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- AA. Set metal floor boxes level and flush with finished floor surface.

3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.4 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage or deterioration.
 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 270528

SECTION 270536 - CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Ladder cable trays.
2. Wire-basket cable trays.

B. Related Requirements:

1. Section 260536 "Cable Trays for Electrical Systems" for cable trays and accessories serving electrical systems.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of cable tray.

1. Include data indicating dimensions and finishes for each type of cable tray indicated.

B. Shop Drawings: For each type of cable tray.

1. Show fabrication and installation details of cable trays, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For cable trays, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Cable trays and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the cable trays will remain in place without separation of any parts when subjected to the seismic forces specified."
 - 2. Component Importance Factor: 1.5.

2.2 GENERAL REQUIREMENTS FOR CABLE TRAYS

- A. Cable Trays and Accessories: Identified as defined in NFPA 70 and marked for intended location, application, and grounding.
 - 1. Source Limitations: Obtain cable trays and components from single manufacturer.
- B. Sizes and Configurations: See the Cable Tray Schedule on Drawings for specific requirements for types, materials, sizes, and configurations.
- C. Structural Performance: See articles for individual cable tray types for specific values for the following parameters:
 - 1. Uniform Load Distribution: Capable of supporting a uniformly distributed load on the indicated support span when supported as a simple span and tested according to NEMA VE 1.
 - 2. Concentrated Load: A load applied at midpoint of span and centerline of tray.
 - 3. Load and Safety Factors: Applicable to both side rails and rung capacities.

2.3 LADDER CABLE TRAYS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Allied Tube & Conduit; a Tyco International Ltd. Co.
 - 2. Chalfant Manufacturing Company.
 - 3. Cooper B-Line, Inc.
 - 4. Mono-Systems, Inc.
 - 5. MP Husky.
 - 6. Niedax-Kleinhuis USA, Inc.
- B. Description:
 - 1. Configuration: Two I-beam side rails with transverse rungs welded to side rails.
 - 2. Rung Spacing: 9 inches (225 mm) o.c.
 - 3. Radius-Fitting Rung Spacing: 9 inches (225 mm) at center of tray's width.
 - 4. Minimum Cable-Bearing Surface for Rungs: 7/8-inch (22-mm) width with radius edges.
 - 5. No portion of the rungs shall protrude below the bottom plane of side rails.
 - 6. Structural Performance of Each Rung: Capable of supporting a maximum cable load, with a safety factor of 1.5, plus a 200-lb (90-kg) concentrated load, when tested according to NEMA VE 1.

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7. Minimum Usable Load Depth: 6 inches (150 mm).
8. Width: 12 inches (300 mm) unless otherwise indicated on Drawings.
9. Fitting Minimum Radius: 12 inches (300 mm).
10. Class Designation: Comply with NEMA VE 1, Class 12C.
11. Splicing Assemblies: Bolted type using serrated flange locknuts.
12. Hardware and Fasteners: ASTM F 593 and ASTM F 594 stainless steel, Type 316.
13. Splice Plate Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.

2.4 WIRE-BASKET CABLE TRAYS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cablofil/Legrande.
 2. Cooper B-Line, Inc.
- B. Description:
1. Configuration: Wires are formed into a standard 2-by-4-inch (50-by-100-mm) wire mesh pattern with intersecting wires welded together. Mesh sections must have at least one bottom longitudinal wire along entire length of section.
 2. Materials: High-strength-steel longitudinal wires with no bends.
 3. Safety Provisions: Wire ends along wire-basket sides (flanges) rounded during manufacturing to maintain integrity of cables and installer safety.
 4. Sizes:
 - a. Straight sections shall be furnished in standard 118-inch (3000-mm) lengths.
 - b. Wire-Basket Depth: 4-inch (100-mm) usable loading depth by 6 inches (150 mm) wide.
 5. Connector Assemblies: Bolt welded to plate shaped to fit around adjoining tray wires and mating plate. Mechanically joins adjacent tray wires to splice sections together or to create horizontal fittings.
 6. Connector Assembly Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.
 7. Hardware and Fasteners: ASTM F 593 and ASTM F 594 stainless steel, Type 316.

2.5 MATERIALS AND FINISHES

- A. Steel:
1. Straight Section and Fitting Side Rails and Rungs: Steel complies with the minimum mechanical properties of ASTM A 1011/A 1011M, SS, Grade 33.
 2. Steel Tray Splice Plates: ASTM A 1011/A 1011M, HSLAS, Grade 50, Class 1.
 3. Fasteners: Steel complies with the minimum mechanical properties of ASTM A 510/A 510M, Grade 1008.
 4. Finish: Hot-dip galvanized after fabrication.
 - a. Standard: Comply with ASTM A 123/A 123M, Class B2.
 - b. Hardware: Chromium-zinc plated, ASTM F 1136.
- B. Aluminum:

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1. Materials: Alloy 6063-T6 according to ANSI H 35.1/H 35.1M for extruded components and Alloy 5052-H32 or Alloy 6061-T6 according to ANSI H 35.1/H 35.1M for fabricated parts.
2. Hardware: Stainless steel, Type 316, ASTM F 593 and ASTM F 594.
3. Hardware for Aluminum Cable Tray Used Outdoors: Stainless steel, Type 316, ASTM F 593 and ASTM F 594.

2.6 CABLE TRAY ACCESSORIES

- A. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.
- B. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

2.7 WARNING SIGNS

- A. Lettering: 1-1/2-inch- (40-mm-) high, black letters on yellow background with legend "Warning! Not To Be Used as Walkway, Ladder, or Support for Ladders or Personnel."
- B. Comply with requirements for fasteners in Section 260553 "Identification for Electrical Systems."

2.8 SOURCE QUALITY CONTROL

- A. Testing: Test and inspect cable trays according to NEMA VE 1.

PART 3 - EXECUTION

3.1 CABLE TRAY INSTALLATION

- A. Install cable trays according to NEMA VE 2.
- B. Install cable trays as a complete system, including fasteners, hold-down clips, support systems, barrier strips, adjustable horizontal and vertical splice plates, elbows, reducers, tees, crosses, cable dropouts, adapters, covers, and bonding.
- C. Install cable trays so that the tray is accessible for cable installation and all splices are accessible for inspection and adjustment.
- D. Remove burrs and sharp edges from cable trays.
- E. Join aluminum cable tray with splice plates; use four square neck-carriage bolts and locknuts.
- F. Fasten cable tray supports to building structure and install seismic restraints.
- G. Design fasteners and supports to carry cable tray, the cables, and a concentrated load of 200 lb (90 kg). Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems." Comply with seismic-restraint details according to Section 260548 "Vibration and Seismic Controls for Electrical Systems."

- H. Place supports so that spans do not exceed maximum spans on schedules and provide clearances shown on Drawings. Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.
- I. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.
- J. Support bus assembly to prevent twisting from eccentric loading.
- K. Install center-hung supports for single-rail trays designed for 60 versus 40 percent eccentric loading condition, with a safety factor of 3.
- L. Locate and install supports according to NEMA VE 2. Do not install more than one cable tray splice between supports.
- M. Support wire-basket cable trays with trapeze hangers or wall brackets.
- N. Make connections to equipment with flanged fittings fastened to cable trays and to equipment. Support cable trays independent of fittings. Do not carry weight of cable trays on equipment enclosure.
- O. Install expansion connectors where cable trays cross building expansion joints and in cable tray runs that exceed dimensions recommended in NEMA VE 2. Space connectors and set gaps according to applicable standard.
- P. Make changes in direction and elevation using manufacturer's recommended fittings.
- Q. Make cable tray connections using manufacturer's recommended fittings.
- R. Seal penetrations through fire and smoke barriers. Comply with requirements in Section 078413 "Penetration Firestopping."
- S. Install capped metal sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.
- T. Install cable trays with enough workspace to permit access for installing cables.
- U. Install warning signs in visible locations on or near cable trays after cable tray installation.

3.2 CABLE TRAY GROUNDING

- A. Ground cable trays according to NFPA 70 unless additional grounding is specified. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Cable trays with communications cable shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.
- C. When using epoxy- or powder-coat painted cable trays as a grounding conductor, completely remove coating at all splice contact points or ground connector attachment. After completing splice-to-grounding bolt attachment, repair the coated surfaces with coating materials recommended by cable tray manufacturer.

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- D. Bond cable trays to power source for cables contained within with bonding conductors sized according to NFPA 70, Article 250.122, "Size of Equipment Grounding Conductors."

3.3 CABLE INSTALLATION

- A. Install cables only when each cable tray run has been completed and inspected.
- B. Fasten and support cables that pass from one cable tray to another or drop from cable trays to equipment enclosures. Fasten cables to the cable tray at the point of exit and support cables independent of the enclosure. The cable length between cable trays or between cable tray and enclosure shall be no more than 72 inches (1800 mm).
- C. In existing construction, remove inactive or dead cables from cable trays.

3.4 CONNECTIONS

- A. Remove paint from all connection points before making connections. Repair paint after the connections are completed.
- B. Connect pathways to cable trays according to requirements in NEMA VE 2 and NEMA FG 1.

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable trays, vibrations, and thermal expansion and contraction conditions, which may cause or have caused damage.
 - 2. Verify that the number, size, and voltage of cables in cable trays do not exceed that permitted by NFPA 70. Verify that communications or data-processing circuits are separated from power circuits by barriers or are installed in separate cable trays.
 - 3. Verify that there are no intruding items such as pipes, hangers, or other equipment in the cable tray.
 - 4. Remove dust deposits, industrial process materials, trash of any description, and any blockage of tray ventilation.
 - 5. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorquing in suspect areas.
 - 6. Check for improperly sized or installed bonding jumpers.
 - 7. Check for missing, incorrect, or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
 - 8. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable trays. Test entire cable tray system for continuity. Maximum allowable resistance is 1 ohm.
- B. Prepare test and inspection reports.

3.6 PROTECTION

- A. Protect installed cable trays and cables.

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1. Install temporary protection for cables in open trays to safeguard exposed cables against falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials and shall remain in place until the risk of damage is over.
2. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.
3. Repair damage to paint finishes with matching touchup coating recommended by cable tray manufacturer.

END OF SECTION 270536

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SECTION 270553 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Color and legend requirements for labels and signs.
 - 2. Labels.
 - 3. Bands and tubes.
 - 4. Tapes.
 - 5. Signs.
 - 6. Cable ties.
 - 7. Fasteners for labels and signs.

1.3 ACTION SUBMITTALS

- A. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.
- B. Identification Schedule:
 - 1. Outlets: Scaled drawings indicating location and proposed designation.
 - 2. Backbone Cabling: Riser diagram showing each communications room, backbone cable, and proposed backbone cable designation.
 - 3. Racks: Scaled drawings indicating location and proposed designation.
 - 4. Patch Panels: Enlarged scaled drawings showing rack row, number, and proposed designations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 70 and TIA 606-B.
- B. Comply with ANSI Z535.4 for safety signs and labels.
- C. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

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

2.2 COLOR AND LEGEND REQUIREMENTS

A. Equipment Identification Labels:

1. Black letters on a white field.

2.3 LABELS

A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

B. Self-Adhesive Wraparound Labels: Preprinted, 3-mil- (0.08-mm-) thick, polyester flexible labels with acrylic pressure-sensitive adhesive.

1. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating protective shields over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
2. Marker for Labels: Machine-printed, permanent, waterproof black ink recommended by printer manufacturer.

C. Self-Adhesive Labels: Polyester, thermal, transfer-printed, 3-mil- (0.08-mm-) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

1. Minimum Nominal Size:

- a. 1-1/2 by 6 inches (37 by 150 mm) for raceway and conductors.
- b. 76 by 127 mm (3-1/2 by 5 inches) for equipment.
- c. As required by authorities having jurisdiction.

2.4 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, and ANSI Z535.4.
2. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL-FIBER CABLE" <Insert inscription>.

2.5 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

PART 3 - EXECUTION

3.1 PREPARATION

- A. Self-Adhesive Identification Products: Before applying communications identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- G. Vinyl Wraparound Labels:
 - 1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
 - 2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
 - 3. Provide label 150 mm (6 inches) from cable end.
- H. Self-Adhesive Labels:
 - 1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
 - 2. Unless otherwise indicated, provide a single line of text with 13-mm- (1/2-inch-) high letters on 38-mm- (1-1/2-inch-) high label; where two lines of text are required, use labels 50 mm (2 inches) high.
- I. Snap-Around, Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.
- J. Underground-Line Warning Tape:

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1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 150 to 200 mm (6 to 8 inches) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 400 mm (16 inches) overall.
2. Install underground-line warning tape for direct-buried cables and cables in raceways.

3.3 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations with high visibility. Identify by system and circuit designation.
- C. Accessible Fittings for Raceways and Cables within Buildings: Identify covers of each junction and pull box with self-adhesive labels containing wiring system legend.
 1. System legends shall be as follows:
 - a. Telecommunications.
- D. Faceplates: Label individual faceplates with self-adhesive labels. Place label at top of faceplate. Each faceplate shall be labeled with its individual, sequential designation, numbered clockwise when entering room from primary egress, composed of the following, in the order listed:
 1. Wiring closet designation.
 2. Colon.
 3. Faceplate number.
- E. Equipment Room Labeling:
 1. Racks, Frames, and Enclosures: Identify front and rear of each with self-adhesive labels containing equipment designation.
 2. Patch Panels: Label individual rows and outlets, starting at to left and working down, with self-adhesive labels.
 3. Data Outlets: Label each outlet with a self-adhesive label indicating the following, in the order listed:
 - a. Room number being served.
 - b. Colon.
 - c. Faceplate number.
- F. Backbone Cables: Label each cable with a self-adhesive wraparound label indicating the location of the far or other end of the backbone cable. Patch panel or punch down block where cable is terminated should be labeled identically.
- G. Horizontal Cables: Label each cable with a self-adhesive wraparound label indicating the following, in the order listed:
 1. Room number.
 2. Colon.
 3. Faceplate number.

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- H. Locations of Underground Lines: Underground-line warning tape for copper, coaxial, hybrid copper/fiber, and optical-fiber cable.
- I. Equipment Identification Labels:
 - 1. Indoor Equipment: Self-adhesive label.
 - 2. Outdoor Equipment: Laminated-acrylic or melamine-plastic sign.
 - 3. Equipment to Be Labeled:
 - a. Communications cabinets.
 - b. Uninterruptible power supplies.
 - c. Computer room air conditioners.
 - d. Fire-alarm and suppression equipment.
 - e. Egress points.
 - f. Power distribution components.

END OF SECTION 270553

SECTION 271513 - COMMUNICATIONS COPPER HORIZONTAL CABLING

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. Category 6a twisted pair cable.
2. Twisted pair cable hardware, including plugs and jacks.
3. Multiuser telecommunications outlet assembly.
4. Cable management system.
5. Grounding provisions for twisted pair cable.
6. Source quality control requirements for twisted pair cable.

B. Related Requirements:

1. Section 270513 "Conductors and Cables for Communications Systems" for data cabling associated with system panels and devices.

1.3 DEFINITIONS

- A. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- B. EMI: Electromagnetic interference.
- C. FTP: Shielded twisted pair.
- D. F/FTP: Overall foil screened cable with foil screened twisted pair.
- E. F/UTP: Overall foil screened cable with unscreened twisted pair.
- F. IDC: Insulation displacement connector.
- G. LAN: Local area network.
- H. Jack: Also commonly called an "outlet," it is the fixed, female connector.
- I. Plug: Also commonly called a "connector," it is the removable, male telecommunications connector.
- J. RCDD: Registered Communications Distribution Designer.
- K. Screen: A metallic layer, either a foil or braid, placed around a pair or group of conductors.

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- L. Shield: A metallic layer, either a foil or braid, placed around a pair or group of conductors.
- M. S/FTP: Overall braid screened cable with foil screened twisted pair.
- N. S/UTP: Overall braid screened cable with unscreened twisted pairs.
- O. UTP: Unscreened (unshielded) twisted pair.

1.4 COPPER HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable cabling system shall provide interconnections between Distributor A, Distributor B, or Distributor C, and the equipment outlet, otherwise known as "Cabling Subsystem 1," in the telecommunications cabling system structure. Cabling system consists of horizontal cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.
 - 1. TIA-568-C.1 requires that a minimum of two equipment outlets be installed for each work area.
 - 2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications equipment outlet.
 - 3. Bridged taps and splices shall not be installed in the horizontal cabling.
- B. A work area is approximately 100 sq. ft. (9.3 sq. m), and includes the components that extend from the equipment outlets to the station equipment.
- C. The maximum allowable horizontal cable length is 295 feet (90 m). This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) to the workstation equipment or in the horizontal cross-connect.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Reviewed and stamped by RCDD.
 - 1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
 - 2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
 - 3. Cabling administration Drawings and printouts.
 - 4. Wiring diagrams and installation details of telecommunications equipment, to show location and layout of telecommunications equipment, including the following:
 - a. Telecommunications rooms plans and elevations.
 - b. Telecommunications pathways.
 - c. Telecommunications system access points.
 - d. Telecommunications grounding system.
 - e. Telecommunications conductor drop locations.
 - f. Typical telecommunications details.
 - g. Mechanical, electrical, and plumbing systems.
- C. Twisted pair cable testing plan.

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1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For RCDD, Installer, installation supervisor, and field inspector.
- B. Product Certificates: For each type of product.
- C. Source quality-control reports.
- D. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For splices and connectors to include in maintenance manuals.
- B. Software and Firmware Operational Documentation:
 - 1. Software operating and upgrade manuals.
 - 2. Program Software Backup: On USB media or compact disk, complete with data files.
 - 3. Device address list.
 - 4. Printout of software application and graphic screens.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Connecting Blocks: One of each type.
 - 2. Faceplates: One of each type.
 - 3. Jacks: Ten of each type.
 - 4. Patch-Panel Units: One of each type.
 - 5. Plugs: Ten of each type.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - 1. Layout Responsibility: Preparation of Shop Drawings by an RCDD.
 - 2. Installation Supervision: Installation shall be under the direct supervision of Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.
 - 3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
 - 1. Test each pair of twisted pair cable for open and short circuits.

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1.11 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.12 COORDINATION

- A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

1.13 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 - 1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.
- B. Telecommunications Pathways and Spaces: Comply with TIA-569-D.
- C. Grounding: Comply with TIA-607-B.

2.2 GENERAL CABLE CHARACTERISTICS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:
 - 1. Communications, Plenum Rated: Type CMP complying with UL 1685 or Type CMP in listed plenum communications raceway or Type CMP in listed cable routing assembly.
- B. Surface-Burning Characteristics: Comply with ASTM E 84; 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.

- C. RoHS compliant.

2.3 CATEGORY 6a TWISTED PAIR CABLE

- A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 6a cable at frequencies up to 500MHz.
 - 1. Belden CDT Networking Division/NORDX.
 - 2. CommScope, Inc.
 - 3. Hitachi Cable America Inc.
 - 4. Leviton.
 - 5. Mohawk; a division of Belden Networking, Inc.
 - 6. Siemon Co. (The).
 - 7. SYSTIMAX Solutions; a CommScope Inc. brand.
- B. Standard: Comply with TIA-568-C.2 for Category 6a cables.
- C. Conductors: 100-ohm, 23 AWG solid copper.
- D. Shielding/Screening: Unshielded twisted pairs (UTP).
- E. Cable Rating: Plenum.
- F. Jacket: Blue thermoplastic.

2.4 TWISTED PAIR CABLE HARDWARE

- A. Description: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.
- B. General Requirements for Twisted Pair Cable Hardware:
 - 1. Comply with the performance requirements of Category 6a.
 - 2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
 - 3. Cables shall be terminated with connecting hardware of same category or higher.
- C. Source Limitations: Obtain twisted pair cable hardware from same manufacturer as twisted pair cable, from single source.
- D. Connecting Blocks:
 - 1. 110-style IDC for Category 6a.
 - 2. Provide blocks for the number of cables terminated on the block, plus 25 percent spare, integral with connector bodies, including plugs and jacks where indicated.
- E. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.
 - 1. Number of Terminals per Field: One for each conductor in assigned cables.
- F. Patch Panel: Modular panels housing numbered jack units with IDC-type connectors at each jack location for permanent termination of pair groups of installed cables.

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1. Features:
 - a. Universal T568A and T568B wiring labels.
 - b. Labeling areas adjacent to conductors.
 - c. Replaceable connectors.
 - d. 24 or 48 ports.
2. Construction: 16-gauge steel and mountable on 19-inch (483 mm) equipment racks.
3. Number of Jacks per Field: One for each four-pair cable indicated.

G. Patch Cords: Factory-made, four-pair cables in 48-inch (1200-mm) lengths; terminated with an eight-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords shall have latch guards to protect against snagging.
2. Patch cords shall have color-coded boots for circuit identification.

H. Plugs and Plug Assemblies:

1. Male; eight position; color-coded modular telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
2. Standard: Comply with TIA-568-C.2.
3. Marked to indicate transmission performance.

I. Jacks and Jack Assemblies:

1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
2. Designed to snap-in to a patch panel or faceplate.
3. Standard: Comply with TIA-568-C.2.
4. Marked to indicate transmission performance.

J. Faceplate:

1. Four port, vertical single gang faceplates designed to mount to single gang wall boxes.
2. Eight port, vertical double gang faceplates designed to mount to double gang wall boxes.
3. Plastic Faceplate: High-impact plastic. Coordinate color with Section 262726 "Wiring Devices."
4. For use with snap-in jacks accommodating any combination of twisted pair, optical fiber, and coaxial work area cords.
 - a. Flush mounting jacks, positioning the cord at a 45-degree angle.

K. Legend:

1. Machine printed, in the field, using adhesive-tape label.
2. Snap-in, clear-label covers and machine-printed paper inserts.

2.5 IDENTIFICATION PRODUCTS

- A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

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2.6 GROUNDING

- A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.
- B. Comply with TIA-607-B.

2.7 SOURCE QUALITY CONTROL

- A. Factory test cables on reels according to TIA-568-C.1.
- B. Factory test twisted pair cables according to TIA-568-C.2.
- C. Cable will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays, except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, attics, and gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables, except in unfinished spaces.
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Comply with requirements for raceways and boxes specified in Section 270528 "Pathways for Communications Systems."
- B. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools. Install conductors parallel with or at right angles to sides and back of enclosure.

3.2 INSTALLATION OF PATHWAYS

- A. Comply with requirements for demarcation point, cabinets, and racks specified in Section 271100 "Communications Equipment Room Fittings."
- B. Comply with Section 270528 "Pathways for Communications Systems."
- C. Comply with Section 270529 "Hangers and Supports for Communications Systems."
- D. Comply with Section 270536 "Cable Trays for Communications Systems."
- E. Drawings indicate general arrangement of pathways and fittings.

3.3 INSTALLATION OF TWISTED-PAIR HORIZONTAL CABLES

- A. Comply with NECA 1 and NECA/BICSI 568.
- B. General Requirements for Cabling:
 - 1. Comply with TIA-568-C.0, TIA-568-C.1, and TIA-568-C.2.
 - 2. Comply with BICSI's "Information Transport Systems Installation Methods Manual (ITSIMM), Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.
 - 3. Install 110-style IDC termination hardware unless otherwise indicated.
 - 4. Do not untwist twisted pair cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
 - 5. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
 - 6. Consolidation points may be used only for making a direct connection to equipment outlets:
 - a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
 - b. Locate consolidation points for twisted-pair cables at least 49 feet (15 m) from communications equipment room.
 - 7. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - 8. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.
 - 9. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI Information Transport Systems Installation Methods Manual , Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section. Use lacing bars and distribution spools.
 - 10. 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.
 - 11. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 - 12. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
 - 13. Pulling Cable: Comply with BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Pulling and Installing Cable" Section. Monitor cable pull tensions.
- C. Open-Cable Installation:
 - 1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 - 2. Suspend twisted pair cabling, not in a wireway or pathway, a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 48 inches (1212 mm) apart.
 - 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- D. Installation of Cable Routed Exposed under Raised Floors:
 - 1. Install plenum-rated cable only.
 - 2. Install cabling after the flooring system has been installed in raised floor areas.

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3. Coil cable 6 feet (1800 mm) long not less than 12 inches (300 mm) in diameter below each feed point.

E. Group connecting hardware for cables into separate logical fields.

F. Separation from EMI Sources:

1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-D for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (600 mm).
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
4. Separation between communications cables in grounded metallic raceways, power lines, and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.4 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA-569-D, Annex A, "Firestopping."
- C. Comply with "Firestopping Systems" Article in BICSI's "Telecommunications Distribution Methods Manual."

3.5 GROUNDING

- A. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."
- B. Comply with TIA-607-B and NECA/BICSI-607.

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- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall, allowing at least a 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar to suitable electrical building ground, using a minimum No. 4 AWG grounding electrode conductor.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than a No. 6 AWG equipment grounding conductor.

3.6 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."
 - 1. Administration Class: Class 1.
 - 2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.
- B. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- C. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.
- D. Cable and Wire Identification:
 - 1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
 - 2. Each wire connected to building-mounted devices is not required to be numbered at the device if wire color is consistent with associated wire connected and numbered within panel or cabinet.
 - 3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
 - 4. Label each terminal strip, and screw terminal in each cabinet, rack, or panel.
 - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group, extended from a panel or cabinet to a building-mounted device, with the name and number of a particular device.
 - b. Label each unit and field within distribution racks and frames.
 - 5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and -connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- E. Labels shall be preprinted or computer-printed type, with a printing area and font color that contrast with cable jacket color but still comply with TIA-606-B requirements for the following:
 - 1. Cables use flexible vinyl or polyester that flexes as cables are bent.

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3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections with the assistance of a factory-authorized service representative.
- B. Tests and Inspections:
 - 1. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.
 - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 - 3. Test twisted pair cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
 - a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
- C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, saved as text files, printed, and submitted.
- D. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
- E. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

3.8 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 - 1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

END OF SECTION 271513

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SECTION 271533 - COMMUNICATIONS COAXIAL HORIZONTAL CABLING

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. Communications coaxial cable.
 - 2. CATV coaxial cable.
 - 3. Coaxial cable hardware.
 - 4. Grounding.
 - 5. Identification products.

1.3 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. EMI: Electromagnetic interference.
- C. IDC: Insulation displacement connector.
- D. LAN: Local area network.
- E. RCDD: Registered Communications Distribution Designer.

1.4 COAXIAL HORIZONTAL CABLING DESCRIPTION

- A. Coaxial horizontal cabling system shall provide interconnections between Distributor A, Distributor B, or Distributor C and the equipment outlet, otherwise known as "Cabling Subsystem 1" in the telecommunications cabling system structure. Cabling system consists of horizontal cables, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Nominal OD.
 - 2. Minimum bending radius.
 - 3. Maximum pulling tension.

- B. Shop Drawings:

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1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
3. Cabling administration drawings and printouts.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For RCDD, Installer, installation supervisor, and field inspector.
- B. Source quality-control reports.
- C. Field quality-control reports.
- D. Maintenance Data: For splices and connectors to include in maintenance manuals.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For coaxial cable, splices, and connectors to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 1. Layout Responsibility: Preparation of Shop Drawings and Cabling Administration Drawings, Cabling Administration Drawings, and field testing program development by an RCDD.
 2. Installation Supervision: Installation shall be under the direct supervision of Technician, who shall be present at all times when Work of this Section is performed at Project site.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
 1. Test each coaxial cable on the reel for continuity.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.11 COORDINATION

- A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard, and the requirements of TIA-568-C.4.
- B. Telecommunications Pathways and Spaces: Comply with TIA-569-D.
- C. Grounding: Comply with TIA-607-B.

2.2 GENERAL CABLE CHARACTERISTICS

- A. Communications Cable: Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:
 - 1. Communications, Plenum Rated: Type CMP complying with UL 1685 or Type CMP in listed plenum communications raceway or Type CMP in listed cable routing assembly.

2.3 COMMUNICATIONS COAXIAL CABLE

- A. Description: Coaxial cable with a 75-ohm characteristic impedance designed for broadband data transmission.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alpha Wire.
 - 2. Belden CDT Networking Division/NORDX.
 - 3. Coleman Cable, Inc.
 - 4. CommScope, Inc.
 - 5. Draka USA.
- C. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 13, and with NFPA 70, "Class 1, Class 2, and Class 3 Remote-Control, Signaling, and Power-Limited Circuits" and "Communications Circuits" articles. Types are as follows:
 - 1. RG-6/U: UL Type CMP and CL2P.
 - a. No. 16 AWG, solid, copper-covered steel conductor.
 - b. Plenum rated.
 - c. Gas-injected, foam-PE insulation.
 - d. Shielded with 100 percent aluminum tape and 40 percent aluminum braid.
 - e. Double shielded with 100 percent aluminum foil shield, 60 percent aluminum braided inner shield, and 40 percent aluminum braided outer shield.
 - f. Jacketed with white PVC or PE.
 - g. Suitable for indoor installations.

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2.4 COAXIAL CABLE HARDWARE

- A. Description: Hardware designed to connect, splice, and terminate coaxial cable with a 75-ohm characteristic impedance.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Emerson Network Power Connectivity Solutions.
 - 2. Leviton Manufacturing Co., Inc.
 - 3. Siemon Co. (The).
- C. Coaxial-Cable Connectors: Type BNC, 75 ohms.
- D. Jacks and Jack Assemblies: Modular, color-coded, with female Type BNC connectors.
- E. Patch Cords: Factory-made cables; terminated with a male Type BNC connector at each end.
- F. Faceplates:
 - 1. Plastic Faceplate: High-impact plastic. Coordinate color with Section 262726 "Wiring Devices."
 - 2. Metal Faceplate: Stainless steel, complying with requirements in Section 262726 "Wiring Devices."
 - 3. For use with snap-in jacks accommodating any combination of twisted pair, optical-fiber, and coaxial work area cords.
 - a. Flush-mounted jacks, positioning the cord at a 90-degree angle from faceplate surface.
 - 4. Legend:
 - a. Factory labeled by silk-screening or engraving for faceplates.
 - b. Snap-in, clear-label covers and machine-printed paper inserts.

2.5 GROUNDING

- A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.
- B. Comply with TIA-607-B.

2.6 IDENTIFICATION PRODUCTS

- A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.7 SOURCE QUALITY CONTROL

- A. Cable will be considered defective if it does not pass tests and inspections.
- B. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, in attics, and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.
 - 1. Install plenum-rated cable only.
 - 2. Comply with requirements for raceways and boxes specified in Section 270528 "Pathways for Communications Systems."
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.2 INSTALLATION OF COAXIAL HORIZONTAL CABLES

- A. Comply with NECA 1 and NECA/BICSI 568.
- B. General Requirements for Cabling:
 - 1. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.
 - 2. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and patch panels.
 - 3. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - 4. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
 - 5. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section. Use lacing bars and distribution spools.
 - 6. 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.
 - 7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 - 8. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
 - 9. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems," "Pulling Cable" Section. Monitor cable pull tensions.
- C. Open-Cable Installation:
 - 1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.

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2. Suspend coaxial cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 48 inches (1225 mm) apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

D. Group connecting hardware for cables into separate logical fields.

E. Separation from EMI Sources:

1. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
 - b. Electrical Equipment Rating Between 2 and 5 kVA: A minimum of 12 inches (300 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).
2. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
 - b. Electrical Equipment Rating Between 2 and 5 kVA: A minimum of 6 inches (150 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
3. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating Between 2 and 5 kVA: A minimum of 3 inches (76 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
4. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
5. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.3 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA-569-D, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.4 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with TIA-607-B and NECA/BICSI-607.

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- C. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.5 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.6 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections.
- B. Tests and Inspections:
 - 1. Visually inspect coaxial jacket materials for NRTL certification markings.
 - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 - 3. Test coaxial horizontal copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination.
- C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- D. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
- E. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION 271533

