

SPECIFICATIONS

FOR

RENOVATIONS TO BUILDINGS B, C & D 1049 S. McCord Road, Holland, Ohio

FOR



LUCAS COUNTY BOARD OF COMMISSIONERS

One Government Center, Suite 800
Toledo, Ohio 43604

November 7, 2012

Prepared By:



the COLLABORATIVE *inc*

ARCHITECTURE | LANDSCAPE ARCHITECTURE | INTERIOR DESIGN | PLANNING | GRAPHIC DESIGN

The Collaborative Inc.
500 Madison Ave.
Toledo, Ohio 43604
Phone: 419.242.7405
Fax: 419.242.7400

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SECTION 011000 - SUMMARY

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. Project information.
2. Work covered by Contract Documents.
3. Access to site.
4. Work restrictions.
5. Specification and drawing conventions.
6. Miscellaneous provisions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

A. Project Identification: Renovations to Buildings B, C and D.

1. Project Location: 1049 South McCord Road, Holland, Ohio.

B. Owner: Lucas County Board of Commissioners, One Government Center, Suite 800, Toledo, Ohio 43604.

1. Owner's Representative: Mark Drennen, Administrative Deputy, Lucas County Engineer's Office, One Government Center, Suite 870, Toledo, Ohio 43604.

C. Architect: The Collaborative Inc., 500 Madison Avenue, Toledo, Ohio, 43604.

1. Architect's Representative: Audie Bates, AIA, LEED ® BD+C; (419) 242-7405.

D. Architect's Consultants: The Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:

1. Structural Engineering: Structural Design Systems, Inc., 12875 Eckel Junction, Suite A, Perrysburg, Ohio 43551.
2. Mechanical, Plumbing and Electrical Engineering: MDA Engineering, Inc., 1415 Holland Road, Maumee, Ohio 43537.

- E. Project Web Site: A project Web site administered by Architect will be used for purposes of managing communication and documents during the construction stage. Information on access and available options will be provided to the successful Bidder.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
 - 1. Provide labor, material and equipment necessary to complete the required scope of work shown and indicated on the Bidding Documents for renovations to three (3) buildings located at 1049 South McCord Road in Holland, Ohio. The work includes demolition, new construction, structural headers and supports for new overhead door openings, interior finishes, plumbing, mechanical, electrical and data/communication.
- B. Type of Contract:
 - 1. Project will be constructed under coordinated, concurrent multiple contracts. See Section 011200 "Multiple Contract Summary" for a description of work included under each of the multiple contracts and for the responsibilities of Lead Contractor.

1.5 ACCESS TO SITE

- A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.
- B. Owner's Equipment and Vehicles: The Owner is currently storing vehicles inside of Building 'B'. The vehicles can be moved or relocated to other facilities at the Contractor's request to facilitate construction activity.
- C. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 - 1. Limits: Confine construction operations to areas designated for demolition and/or new construction on the Bidding Documents unless otherwise noted.
 - 2. Driveways, Walkways and Entrances: Keep driveways loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.6 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

- B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:30 a.m. to 4:30 p.m., Monday through Friday, unless otherwise indicated. Contractor may extend or modify working hours as desired by coordinating time and access with Lucas County Engineer's Office.
 - 1. Hours for Utility Shutdowns: Coordinate all utility shutdowns with Owner prior to execution.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
 - 1. Notify Owner not less than two days in advance of proposed utility interruptions.
 - 2. Obtain Owner's written permission before proceeding with utility interruptions.
- D. Nonsmoking Building: Smoking is not permitted within the building or within **25 feet (8 m)** of entrances, operable windows, or outdoor-air intakes.
- E. Controlled Substances: Use of tobacco products and other controlled substances within the existing building is not permitted.
- F. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.
- G. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.

1.7 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The 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. Imperative mood and streamlined language are generally used in the Specifications. 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.
 - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 - 2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 011200 - MULTIPLE CONTRACT SUMMARY

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 a summary of each contract, including responsibilities for coordination and temporary facilities and controls.
- B. Specific requirements for Work of each contract are also indicated in individual Specification Sections and on Drawings.
- C. Related Requirements:
 - 1. Section 011000 "Summary" for the Work covered by the Contract Documents, restrictions on use of Project site, coordination with occupants, and work restrictions.
 - 2. Section 013100 "Project Management and Coordination" for general coordination requirements.

1.3 DEFINITIONS

- A. Permanent Enclosure: As determined by Architect, the condition at which roofing is insulated and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures equivalent in weather protection to permanent construction.

1.4 LEAD CONTRACTOR

- A. Lead Contractor shall be responsible for coordination between the General Construction Contract, Plumbing Contract, HVAC Contract, and Electrical Contract. The Lead Contractor for this project shall be the General Construction (Trades) Contractor.

1.5 COORDINATION ACTIVITIES

- A. Coordination activities of Lead Contractor include, but are not limited to, the following:
 - 1. Provide overall coordination of the Work.
 - 2. Coordinate shared access to workspaces.
 - 3. Coordinate product selections for compatibility.
 - 4. Provide overall coordination of temporary facilities and controls.
 - 5. Coordinate, schedule, and approve interruptions of permanent and temporary utilities, including those necessary to make connections for temporary services.
 - 6. Coordinate construction and operations of the Work with work performed by each Contract.

7. Prepare coordination drawings in collaboration with each contractor to coordinate work by more than one contract.
 8. Coordinate sequencing and scheduling of the Work. Include the following:
 - a. Initial Coordination Meeting: At earliest possible date, arrange and conduct a meeting with contractors for sequencing and coordinating the Work; negotiate reasonable adjustments to schedules.
 - b. Prepare a combined contractors' construction schedule for entire Project. Base schedule on preliminary construction schedule. Secure time commitments for performing critical construction activities from contractors. Show activities of each contract on a separate sheet. Prepare a simplified summary sheet indicating combined construction activities of contracts.
 - 1) Submit schedules for approval.
 - 2) Distribute copies of approved schedules to contractors.
 9. Provide photographic documentation.
 10. Coordinate sequence of activities to accommodate tests and inspections, and coordinate schedule of tests and inspections.
 11. Provide information necessary to adjust, move, or relocate existing utility structures affected by construction.
 12. Provide progress cleaning of common areas and coordinate progress cleaning of areas or pieces of equipment where more than one contractor has worked.
 13. Coordinate cutting and patching.
 14. Coordinate protection of the Work.
 15. Coordinate firestopping.
 16. Coordinate completion of interrelated punch list items.
 17. Coordinate preparation of Project record documents if information from more than one contractor is to be integrated with information from other contractors to form one combined record.
 18. Print and submit record documents if installations by more than one contractor are indicated on the same contract drawing or shop drawing.
 19. Collect record Specification Sections from contractors, collate Sections into numeric order, and submit complete set.
 20. Coordinate preparation of operation and maintenance manuals if information from more than one contractor is to be integrated with information from other contractors to form one combined record.
- B. Responsibilities of Lead Contractor for temporary facilities and controls include, but are not limited to, the following:
1. Provide telephone service for common-use facilities.
 2. Portable toilets.
 3. Potable drinking water.
 4. Waste disposal and recycling containers.

1.6 GENERAL REQUIREMENTS OF CONTRACTS

- A. Extent of Contract: Unless the Agreement contains a more specific description of the Work of each Contract, requirements indicated on Drawings and in Specification Sections determine which contract includes a specific element of Project.
1. Unless otherwise indicated, the work described in this Section for each contract shall be complete systems and assemblies, including products, components, accessories, and installation required by the Contract Documents.

2. Trenches and other excavation for the work of each contract shall be the work of each contract for its own work. Lead Contractor shall be responsible for coordination of trenches, excavation, backfill and repair of concrete floor.
 3. Blocking, backing panels, sleeves, and metal fabrication supports for the work of each contract shall be the work of each contract for its own work.
 4. Furnishing of access panels for the work of each contract shall be the work of each contract for its own work. Installation of access panels shall be the work of the General Construction Contract.
 5. Equipment pads for the work of each contract shall be the work of each contract for its own work.
 6. Roof-mounted equipment curbs for the work of each contract shall be the work of each contract for its own work.
 7. Painting for the work of each contract shall be the work of the General Construction Contract.
 8. Cutting and Patching: Provided under each contract for its own work.
 9. Through-penetration firestopping for the work of each contract shall be provided by each contract for its own work.
 10. Contractors' Startup Construction Schedule: Within five working days after startup horizontal bar-chart-type construction schedule submittal has been received from Project coordinator, submit a matching startup horizontal bar-chart schedule showing construction operations sequenced and coordinated with overall construction.
- B. Substitutions: Each contractor shall cooperate with other contractors involved to coordinate approved substitutions with remainder of the work.
1. Lead Contractor shall coordinate substitutions.
- C. Temporary Facilities and Controls: In addition to specific responsibilities for temporary facilities and controls indicated in this Section and in Section 015000 "Temporary Facilities and Controls," each contractor is responsible for the following:
1. Installation, operation, maintenance, and removal of each temporary facility necessary for its own normal construction activity, and costs and use charges associated with each facility, except as otherwise provided for in this Section.
 2. Plug-in electric power cords and extension cords, supplementary plug-in task lighting, and special lighting necessary exclusively for its own activities.
 3. Its own storage and fabrication sheds.
 4. Temporary enclosures for its own construction activities.
 5. Staging and scaffolding for its own construction activities.
 6. General hoisting facilities for its own construction activities, up to 2 tons (2000 kg).
 7. Waste disposal facilities, including collection and legal disposal of its own hazardous, dangerous, unsanitary, or other harmful waste materials.
 8. Progress cleaning of work areas affected by its operations on a daily basis.
 9. Secure lockup of its own tools, materials, and equipment.
 10. Construction aids and miscellaneous services and facilities necessary exclusively for its own construction activities.
- D. Temporary Heating, Cooling, and Ventilation: The HVAC Contract is responsible for temporary heating, cooling, and ventilation, including temporary connections.
- E. Use Charges: Comply with the following:
1. Water Service: The Owner will provide water service, whether metered or otherwise, for water used by all entities engaged in construction activities at Project site.
 2. Electric Power Service: The Owner will provide electric power service, whether metered or otherwise, for electricity used by all entities engaged in construction activities at Project site.

1.7 GENERAL CONSTRUCTION CONTRACT

- A. Work in the General Construction Contract includes, but is not limited to, the following:
1. Remaining work not identified as work under other contracts.
 2. Selective demolition.
 3. Slabs-on-grade, including earthwork, subdrainage systems, and insulation.
 4. Exterior closure, including walls, doors, windows.
 5. Roofing, including coverings, flashings roof specialties and glazed openings.
 6. Interior construction, including partitions, doors, interior glazed openings, and fittings.
 7. Fire-protection specialties.
 8. Stairs, including railings and finishes.
 9. Interior finishes architectural woodwork and built-in casework.
 10. Miscellaneous items, including painting of mechanical and electrical work.
- B. Temporary facilities and controls in the General Construction Contract include, but are not limited to, the following:
1. Temporary facilities and controls that are not otherwise specifically assigned to the Plumbing Contract, HVAC Contract, and Electrical Contract.
 2. Unpiped temporary toilet fixtures, wash facilities, and drinking water facilities, including disposable supplies.
 3. Temporary enclosure for building exterior, except as indicated.
 4. General waste disposal facilities.
 5. Temporary fire-protection facilities.
 6. Barricades, warning signs, and lights.
 7. Environmental protection.

1.8 PLUMBING CONTRACT

- A. Work in the Plumbing Contract includes, but is not limited to, the following:
1. Plumbing fixtures.
 2. Domestic water distribution.
 3. Sanitary waste.
 4. Special plumbing systems, including the following:
 - a. Natural gas.
 5. Plumbing connections to equipment furnished by the General Construction Contract, Plumbing Contract, HVAC Contract and Electrical Contract.
- B. Temporary facilities and controls in the Plumbing Contract include, but are not limited to, the following:
1. Potable water supply from existing service for use during project.

1.9 HVAC CONTRACT

- A. Work in the HVAC Contract includes, but is not limited to, the following:
1. Energy supply, including gas supply systems.
 2. HVAC systems and equipment.
 3. HVAC instrumentation and controls.

4. HVAC testing, adjusting, and balancing.
5. Building automation system.
6. Mechanical connections to equipment furnished by the General Construction Contract, Plumbing Contract, HVAC Contract, and Electrical Contract.

1.10 ELECTRICAL CONTRACT

A. Work in the Electrical Contract includes, but is not limited to, the following:

1. Electrical service and distribution.
2. Exterior and interior lighting.
3. Communication and security.
4. Site Technology and fiber optic cabling.
5. Electrical connections to equipment furnished by the General Construction Contract, Plumbing Contract, HVAC Contract, and Electrical Contract.

B. Temporary facilities and controls in the Electrical Contract include, but are not limited to, the following:

1. Electric power service and distribution.
2. Lighting, including site lighting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011200

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements governing allowances.
 - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
 - 1. Contingency allowances.

1.3 CONTINGENCY ALLOWANCES

- A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.
- B. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs for equipment and labor only. No overhead and profit margins will be included in the Contingency Allowance expenditures.
- C. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.
- D. Contingency Allowances are indicated by contract including general trades, plumbing, fire protection (if any), mechanical and electrical contracts and must be included in the bidder's bid number, including combined bids.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALLOWANCES

- A. Allowance No. 1: General Trades Contingency Allowance: Include a contingency allowance of \$20,000.00 for use according to Owner's written instructions.

1. If preparing bids separately for general trades or bidding only one building provide the following General Trades Contingency Allowance as noted.
 - a. Building 'B': \$10,000.00.
 - b. Building 'C-D': \$10,000.00.

- B. Allowance No. 2: Plumbing Contingency Allowance: Include a contingency allowance of \$10,000.00 for use according to Owner's written instructions.
 1. If preparing bids separately for plumbing or bidding only one building provide the following Plumbing Contingency Allowance as noted.
 - a. Building 'B': \$3,000.00.
 - b. Building 'C-D': \$7,000.00.

- C. Allowance No. 3: Mechanical Contingency Allowance: Include a contingency allowance of \$10,000.00 for use according to Owner's written instructions.
 1. If preparing bids separately for mechanical or bidding only one building provide the following Mechanical Contingency Allowance as noted.
 - a. Building 'B': \$5,000.00.
 - b. Building 'C-D': \$5,000.00.

- D. Allowance No. 4: Electrical Contingency Allowance: Include a contingency allowance of \$15,000.00 for use according to Owner's written instructions.
 1. If preparing bids separately for electrical or bidding only one building provide the following Electrical Contingency Allowance as noted.
 - a. Building 'B': \$5,000.00.
 - b. Building 'C-D': \$10,000.00.

END OF SECTION 012100

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for unit prices.
- B. Related Requirements:
 - 1. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.

1.3 DEFINITIONS

- A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, overhead, and profit.
- B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
- D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

- A. Unit Price 1: Replacement of 2x4 roof purlins over Building 'C'.
1. Description: Remove decayed or damaged existing wood 2x4 roof purlins discovered during re-roof of Building 'C'. Replace removed items with new, pressure-preservative-treated wood 2x4 roof purlins. Provide necessary fasteners to secure new work to existing wood roof trusses.
 2. Unit of Measurement: Lineal foot of material specified.
- B. Unit Price 2: Replacement of 2x6 roof purlins over Building 'C'.
1. Description: Remove decayed or damaged existing wood 2x6 roof purlins discovered during re-roof of Building 'C'. Replace removed items with new, pressure-preservative-treated wood 2x6 roof purlins. Provide necessary fasteners to secure new work to existing wood roof trusses.
 2. Unit of Measurement: Lineal foot of material specified.
- C. Unit Price 3: Replacement of 2x8 roof purlins over Building 'C'.
1. Description: Remove decayed or damaged existing wood 2x8 roof purlins discovered during re-roof of Building 'C'. Replace removed items with new, pressure-preservative-treated wood 2x8 roof purlins. Provide necessary fasteners to secure new work to existing wood roof trusses.
 2. Unit of Measurement: Lineal foot of material specified.
- D. Unit Price 4: Replacement of 2x10 roof purlins over Building 'C'.
1. Description: Remove decayed or damaged existing wood 2x10 roof purlins discovered during re-roof of Building 'C'. Replace removed items with new, pressure-preservative-treated wood 2x10 roof purlins. Provide necessary fasteners to secure new work to existing wood roof trusses.
 2. Unit of Measurement: Lineal foot of material specified.
- E. Unit Price 5: Replacement of 2x12 roof purlins over Building 'C'.
1. Description: Remove decayed or damaged existing wood 2x12 roof purlins discovered during re-roof of Building 'C'. Replace removed items with new, pressure-preservative-treated wood 2x12 roof purlins. Provide necessary fasteners to secure new work to existing wood roof trusses.
 2. Unit of Measurement: Lineal foot of material specified.
- F. Unit Price 6: Replacement of 2x6 exterior wall purlins within Building 'C'.
1. Description: Remove decayed or damaged existing wood 2x6 wall purlins discovered during creation of new overhead door openings in exterior wall of Building 'C'. Replace removed items with new, pressure-preservative-treated wood 2x6 wall purlins. Provide necessary fasteners to secure new work to existing structural wood poles and new framing.
 2. Unit of Measurement: Lineal foot of material specified.

END OF SECTION 012200

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. Alternate No. 1: Standing Seam Metal Roofing Over Building 'C'.
1. Base Bid: Remove existing metal roofing from Building 'C' and provide new corrugated, lap seam, metal roofing panels as indicated on Sheet A1.02 "Roof Plan, Enlarged Plans & Interior Elevations" and as specified in Section 074113.13 "Formed Metal Roof Panels."
 2. Alternate: Remove existing metal roofing from Building 'C' and provide new standing-seam, metal roofing panels as indicated on Sheet A1.02 "Roof Plan, Enlarged Plans & Interior Elevations" and as specified in Section 074113.16 "Standing-Seam Metal Roof Panels."

END OF SECTION 012300

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Section 012100 "Allowances" for products selected under an allowance.
 - 2. Section 012300 "Alternates" for products selected under an alternate.

1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use facsimile of form provided at the end of this Section.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
 - b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

- d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - i. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - j. Cost information, including a proposal of change, if any, in the Contract Sum.
 - k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
 - l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor through Construction Manager of acceptance or rejection of proposed substitution within seven days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Requested substitution provides sustainable design characteristics that specified product provided.
 - c. Substitution request is fully documented and properly submitted.
 - d. Requested substitution will not adversely affect Contractor's construction schedule.
 - e. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - f. Requested substitution is compatible with other portions of the Work.
 - g. Requested substitution has been coordinated with other portions of the Work.
 - h. Requested substitution provides specified warranty.
 - i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

- B. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after commencement of the Work. Requests received after that time may be considered or rejected at discretion of Architect.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Requested substitution provides sustainable design characteristics that specified product provided.
 - e. Substitution request is fully documented and properly submitted.
 - f. Requested substitution will not adversely affect Contractor's construction schedule.
 - g. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - h. Requested substitution is compatible with other portions of the Work.
 - i. Requested substitution has been coordinated with other portions of the Work.
 - j. Requested substitution provides specified warranty.
 - k. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

SUBSTITUTION REQUEST FORM

TO: The Lathrop Company PROJECT: New Road Maintenance Facility for the Lucas
 County Engineer
 460 West Dussel Drive Lucas County Board of Commissioners
 Maumee, Ohio 43537 Holland, Ohio
 (419) 893-7000 Bid Package: General Trades and MEP

A/E Project Number: 106049 Date: _____

Submitted for consideration is the following product instead of the specified item for the above-noted Project.

Specification Section and Paragraph: _____

Drawings and Details affected: _____

Proposed Substitution Description: _____

Manufacturer's Name: _____

WHY IS SUBSTITUTION BEING SUBMITTED? (Select one of the following):

	Pre-Bid Substitution (Prior Approval): Include detailed analysis comparing proposed substitution against the specified product(s), including redlined specification sections showing differences.
	Specified Product is not or no longer available. Explain in detail in attached letter.
	Cost Savings to Owner. Indicate comparative cost analysis as attachment.
	Other. Explain in attachment to this substitution request.

EFFECTS OF PROPOSED SUBSTITUTION

(Attach complete explanations and technical data, including laboratory test, if applicable.)

Include complete information changes to Drawings and/or Specifications that proposed substitution would require for its proper installation. Fill in the blanks below.

- Does the substitution affect dimensions shown on Drawings? No Yes
- will the undersigned pay for changes to building design, including Engineering and detailing costs caused by the requested substitution? No Yes
- What affect does substitution have on other trades?

- What are the differences between the proposed and specified items?

- Manufacturer's guarantees of proposed and specified item? Same Different
(If different, provide explanation on separate attachment.)
- Manufacturer's dimensions of proposed and specified item? Same Different
(If different, provide explanation on separate attachment.)
-

- Manufacturer's weight of proposed and specified item? Same Different
 (If different or not applicable, provide explanation on separate attachment.)

The undersigned states that function, appearance, finish, size, weight and quality of the proposed substitution are equivalent or superior to the specified item unless clearly stated as different on included attachments.

SUBMITTED BY:

(Include name, address, telephone, and contact person of manufacturer/supplier of proposed substitution.)

For Design Team Use:

	Accepted			Accepted As Noted
	Not Accepted			Received too late to review
	Incomplete Information			
	No Substitution Allowed for specified item			

Reviewed by: _____

Date: _____

Comments: _____

For Construction Manager's Use:

Reviewed by and Date: _____

END OF SECTION 012500

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
1. General coordination procedures.
 2. Requests for Information (RFIs).
 3. Project Web site.
 4. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- C. Related Requirements:
1. Section 011200 "Multiple Contract Summary" for a description of the division of work among separate contracts and responsibility for coordination activities not in this Section.
 2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

- A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
1. Name, address, and telephone number of entity performing subcontract or supplying products.
 2. Number and title of related Specification Section(s) covered by subcontract.
 3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home,

office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office, on Project Web site, and by each temporary telephone. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

- A. Lead Contractor: The General Trades Contractor shall be designated as the Lead Contractor for this project and responsible for the requirements designated under the Lead Contractor for the Contract Documents.
- B. Coordination: The Lead Contractor is responsible for coordination of the overall project and work of the other Prime Trade Contractors. Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 2. Coordinate installation of different components with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
- C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- D. Administrative Procedures: The Lead Contractor shall coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 1. Preparation of Contractor's construction schedule.
 2. Installation and removal of temporary facilities and controls.
 3. Progress meetings.
 4. Preinstallation conferences.
 5. Project closeout activities.
 6. Startup and adjustment of systems.
- E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.6 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, the responsible Prime Trade Contractor shall prepare and submit an RFI in the form specified.
1. Architect will return RFIs submitted to Architect by other entities controlled by Prime Trade Contractor with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
 2. Date.
 3. Name of Contractor.
 4. RFI subject.
 5. Specification Section number and title and related paragraphs, as appropriate.
 6. Drawing number and detail references, as appropriate.
 7. Field dimensions and conditions, as appropriate.
 8. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 9. Contractor's signature.
 10. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect or as provided on the Project Website.
1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Architect's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.

3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."

a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

E. RFI Log: Each Prime Trade Contractor shall prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log. Use software log that is part of Project Web site. Include the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.

1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.7 PROJECT WEB SITE

A. Use Architect's Project Web site for purposes of hosting and managing project communication and documentation until Final Completion. Project Web site shall include the following functions:

1. Project directory.
2. Meeting minutes.
3. RFI forms and logs.
4. Submittals forms and logs.
5. Drawing and specification document hosting, viewing, and updating.

B. Contractor, subcontractors, and other parties granted access by Contractor to Project Web site shall execute a data licensing agreement in the form of Agreement acceptable to Owner and Architect.

1.8 PROJECT MEETINGS

A. General: The Lead Contractor shall schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.

3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
- B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
1. Conduct the conference to review responsibilities and personnel assignments.
 2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Critical work sequencing and long-lead items.
 - c. Designation of key personnel and their duties.
 - d. Lines of communications.
 - e. Procedures for processing field decisions and Change Orders.
 - f. Procedures for RFIs.
 - g. Procedures for processing Applications for Payment.
 - h. Distribution of the Contract Documents.
 - i. Submittal procedures.
 - j. Preparation of record documents.
 - k. Use of the premises and existing building.
 - l. Work restrictions.
 - m. Working hours.
 - n. Owner's occupancy requirements.
 - o. Responsibility for temporary facilities and controls.
 - p. Procedures for disruptions and shutdowns.
 - q. Construction waste management and recycling.
 - r. Parking availability.
 - s. Office, work, and storage areas.
 - t. Equipment deliveries and priorities.
 - u. First aid.
 - v. Security.
 - w. Progress cleaning.
 4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Progress Meetings: The Lead Contractor shall conduct progress meetings at biweekly intervals.
1. Coordinate dates of meetings with preparation of payment requests.
 2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule

revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

- 1) Review schedule for next period.
- b. Review present and future needs of each entity present, including the following:
 - 1) Status of submittals.
 - 2) Deliveries.
 - 3) Off-site fabrication.
 - 4) Access.
 - 5) Site utilization.
 - 6) Progress cleaning.
 - 7) Status of correction of deficient items.
 - 8) Field observations.
 - 9) Status of RFIs.
 - 10) Status of proposal requests.
 - 11) Pending changes.
 - 12) Status of Change Orders.
 - 13) Pending claims and disputes.
 - 14) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
 - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- D. Coordination Meetings: Lead Contractor will conduct Project coordination meetings at weekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
 1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
 - c. Review present and future needs of each contractor present, including the following:
 - 1) Sequence of operations.
 - 2) Status of submittals.
 - 3) Deliveries.

- 4) Off-site fabrication.
 - 5) Access.
 - 6) Site utilization.
 - 7) Temporary facilities and controls.
 - 8) Work hours.
 - 9) Progress cleaning.
 - 10) Change Orders.
3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013300 - SUBMITTAL PROCEDURES

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 requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
 - 1. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 2. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."
- C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.

- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
 4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
- D. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 2. Name file with submittal number or other unique identifier, including revision identifier.
 - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).
 3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
 4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner, containing the following information:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name of Contractor.
 - e. Name of firm or entity that prepared submittal.
 - f. Names of manufacturer or supplier.
 - g. Drawing number and detail references, as appropriate.
 - h. Location(s) where product is to be installed, as appropriate.
 - i. Related physical samples submitted directly.
 - j. Indication of full or partial submittal.

- k. Transmittal number, numbered consecutively.
 - l. Submittal and transmittal distribution record.
 - m. Other necessary identification.
 - n. Remarks.
- E. Options: Identify options requiring selection by Architect.
- F. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
- 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- I. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
- 1. Post electronic submittals for Action and Informational as PDF electronic files directly to specified email address provided at preconstruction meeting for processing of electronic submittals. If file attachments exceed five (5.0) megabytes, notify Architect and post on Architect's Project Website specifically established for Project.
 - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 - 2. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 - a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
 - b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Notation of coordination requirements.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data before or concurrent with Samples.
 6. Submit Product Data in the following format:
 - a. PDF electronic file.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Architect's digital data drawing files is otherwise permitted.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least **8-1/2 by 11 inches (215 by 280 mm)**, but no larger than **30 by 42 inches (750 by 1067 mm)**.
 3. Submit Shop Drawings in the following format:
 - a. PDF electronic file.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.

- d. Number and title of applicable Specification Section.
 - e. Specification paragraph number and generic name of each item.
3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
- a. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
- a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
- a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- E. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."
- F. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."
- 2.2 DELEGATED-DESIGN SERVICES
- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
- 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

- A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 013300

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

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 requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.3 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.
- B. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
- C. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
 - 1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
 - 2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
 - 3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

- D. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
1. Locations of dust-control partitions at each phase of work.
 2. HVAC system isolation schematic drawing.
 3. Location of proposed air-filtration system discharge.
 4. Waste handling procedures.
 5. Other dust-control measures.

1.5 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in ICC/ANSI A117.1.

1.6 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches (914 by 1624 mm).
- B. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
 - 1. Toilets: Use of Owner's existing toilet facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- C. Heating: Provide temporary heating required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- D. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- E. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
- F. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
 - 2. Install lighting for Project identification sign.
- G. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel.
 - 1. At each telephone, post a list of important telephone numbers.
 - a. Police and fire departments.
 - b. Ambulance service.
 - c. Contractor's emergency after-hours telephone number.
 - d. Architect's office.
 - e. Engineers' offices.
 - f. Owner's office.
 - g. Principal subcontractors' field and home offices.
 - 2. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

3.3 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.
- C. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- D. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
 - 1. Prohibit smoking in construction areas.
 - 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 - 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 - 4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.4 MOISTURE AND MOLD CONTROL

- A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.
- B. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
 - 1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 - 2. Keep interior spaces reasonably clean and protected from water damage.
 - 3. Periodically collect and remove waste containing cellulose or other organic matter.
 - 4. Discard or replace water-damaged material.
 - 5. Do not install material that is wet.
 - 6. Discard, replace, or clean stored or installed material that begins to grow mold.
 - 7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

3.5 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
 3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 012100 "Allowances" for products selected under an allowance.
 - 2. Section 012300 "Alternates" for products selected under an alternate.
 - 3. Section 012500 "Substitution Procedures" for requests for substitutions.

1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
 - a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
 - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
1. Store products to allow for inspection and measurement of quantity or counting of units.
 2. Store materials in a manner that will not endanger Project structure.
 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.

6. Protect stored products from damage and liquids from freezing.
7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Architect will make selection.
 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
 6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. Product Selection Procedures:
 1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 3. Products:
 - a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
 - b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
 4. Manufacturers:
 - a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
 - b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
 5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
- C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.
- ## 2.2 COMPARABLE PRODUCTS
- A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.

2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

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 general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Installation of the Work.
2. Cutting and patching.
3. Progress cleaning.
4. Starting and adjusting.
5. Protection of installed construction.

- B. Related Requirements:

1. Section 011000 "Summary" for limits on use of Project site.
2. Section 013300 "Submittal Procedures" for submitting surveys.
3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
4. Section 024119 "Selective Demolition" for demolition and removal of selected portions of the building.
5. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 QUALITY ASSURANCE

- A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:
 - a. Primary operational systems and equipment.
 - b. Fire separation assemblies.
 - c. Air or smoke barriers.
 - d. Fire-suppression systems.
 - e. Mechanical systems piping and ducts.
 - f. Control systems.
 - g. Communication systems.
 - h. Fire-detection and -alarm systems.
 - i. Conveying systems.
 - j. Electrical wiring systems.
 - k. Operating systems of special construction.
 3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
 - a. Water, moisture, or vapor barriers.
 - b. Membranes and flashings.
 - c. Exterior curtain-wall construction.
 - d. Sprayed fire-resistive material.
 - e. Equipment supports.
 - f. Piping, ductwork, vessels, and equipment.
 - g. Noise- and vibration-control elements and systems.
 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- B. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.
- C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
1. Description of the Work.
 2. List of detrimental conditions, including substrates.
 3. List of unacceptable installation tolerances.
 4. Recommended corrections.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of

Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

3.3 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 - 4. Maintain minimum headroom clearance of 96 inches (2440 mm) in occupied spaces and 90 inches (2300 mm) in unoccupied spaces.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.4 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 6. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.

- b. Restore damaged pipe covering to its original condition.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.5 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Use containers intended for holding waste materials of type to be stored.
 4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 1. Remove liquid spills promptly.
 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.6 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Recycling nonhazardous demolition and construction waste.
 - 2. Disposing of nonhazardous demolition and construction waste.
- B. Related Requirements:
 - 1. Section 011200 "Multiple Contract Summary" for coordination of responsibilities for waste management.
 - 2. Section 024119 "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.
 - 3. Section 042000 "Unit Masonry" for disposal requirements for masonry waste.

1.3 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

1.4 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 7 days of date established for the Notice of Award.

1.5 INFORMATIONAL SUBMITTALS

- A. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

1.7 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
 - 1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."
- B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
 - 1. Distribute waste management plan to everyone concerned within three days of submittal return.
 - 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
 - 2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.
- C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

- D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.
 2. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.3 RECYCLING DEMOLITION WASTE

- A. Metals: Separate metals by type.
1. Structural Steel: Stack members according to size, type of member, and length.
 2. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- B. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
- C. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
1. Store clean, dry carpet and pad in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

3.4 RECYCLING CONSTRUCTION WASTE

- A. Wood Materials:
1. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

3.5 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION 017419

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.
- B. Related Requirements:
 - 1. Section 017300 "Execution" for progress cleaning of Project site.
 - 2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.3 ACTION SUBMITTALS

- A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- B. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
 5. Submit test/adjust/balance records.
 6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 3. Complete startup and testing of systems and equipment.
 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
 6. Advise Owner of changeover in heat and other utilities.
 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 9. Complete final cleaning requirements, including touchup painting.
 10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor

of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.7 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Contract Requirements.
 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Submit pest-control final inspection report.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.
 4. Submit list of incomplete items in the following format:
 - a. MS Excel electronic file. Architect will return annotated file.

1.9 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
 - 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.
 - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark 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 Installer.
 - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
 - 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.

- b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
- c. Remove tools, construction equipment, machinery, and surplus material from Project site.
- d. Remove snow and ice to provide safe access to building.
- e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
- f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
- g. Sweep concrete floors broom clean in unoccupied spaces.
- h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
- i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
- j. Remove labels that are not permanent.
- k. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
- l. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
- m. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
- n. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
- o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
- p. Leave Project clean and ready for occupancy.

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Product maintenance manuals.
 - 2. Systems and equipment maintenance manuals.
- B. Related Requirements:
 - 1. Section 011200 "Multiple Contract Summary" for coordinating operation and maintenance manuals covering the Work of multiple contracts.
 - 2. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:
 - 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
 - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
 - b. Enable inserted reviewer Comments on draft submittals.

- C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
 - 1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - 1. Title page.
 - 2. Table of contents.
 - 3. Manual contents.
- B. Title Page: Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of Owner.
 - 4. Date of submittal.
 - 5. Name and contact information for Contractor.
 - 6. Name and contact information for Construction Manager.
 - 7. Name and contact information for Architect.
 - 8. Name and contact information for Commissioning Authority.
 - 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 - 10. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
 - 1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
 - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 - 2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the

system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

2.2 PRODUCT MAINTENANCE MANUALS

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Color, pattern, and texture.
 - 4. Material and chemical composition.
 - 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

2.3 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 3. Identification and nomenclature of parts and components.
 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
 2. Troubleshooting guide.
 3. Precautions against improper maintenance.
 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 5. Aligning, adjusting, and checking instructions.
 6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

- C. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
 - 1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

- D. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
 - 1. Do not use original project record documents as part of operation and maintenance manuals.
 - 2. Comply with requirements of newly prepared record Drawings in Section 017839 "Project Record Documents."

- E. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
- B. Related Requirements:
 - 1. Section 011200 "Multiple Contract Summary" for coordinating project record documents covering the Work of multiple contracts.
 - 2. Section 017300 "Execution" for final property survey.
 - 3. Section 017700 "Closeout Procedures" for general closeout procedures.

1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit copies of record Drawings as follows:
 - a. Final Submittal:
 - 1) Submit three paper-copy set(s) of marked-up record prints.
 - 2) Submit PDF electronic files of scanned record prints and three set(s) of prints.
 - 3) Print each drawing, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
 - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Locations and depths of underground utilities.
 - d. Revisions to routing of piping and conduits.
 - e. Revisions to electrical circuitry.
 - f. Duct size and routing.
 - g. Locations of concealed internal utilities.
 - h. Changes made by Change Order or Construction Work Change Directive.
 - i. Changes made following Architect's written orders.
 - j. Field records for variable and concealed conditions.
 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Format: Annotated PDF electronic file with comment function enabled.
 3. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect.
 - e. Name of Contractor.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

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

END OF SECTION 017839

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Demolition and removal of selected portions of building or structure.

- B. Related Requirements:

- 1. Section 011000 "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
 - 2. Section 017300 "Execution" for cutting and patching procedures.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- C. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 INFORMATIONAL SUBMITTALS

- A. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

1.6 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.
- B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.7 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
 - 1. Before selective demolition, Owner will remove the following items:
 - a. Traffic signaling devices stored in Building "D".
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. Hazardous materials will be removed by Owner before start of the Work.
 - 2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.

- C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 - 2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.

3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Comply with requirements for access and protection specified in Section 015000 "Temporary Facilities and Controls."
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 - 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
 - 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."

- C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
 - 1. Strengthen or add new supports when required during progress of selective demolition.

3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
 - 5. Maintain adequate ventilation when using cutting torches.
 - 6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 - 7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 - 8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - 9. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."
- B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.
- B. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.
- C. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings."
- D. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight. See Section 074113.13 "Formed Metal Roof Panels" for new roofing requirements.

1. Remove existing roofing system down to substrate.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 1. Do not allow demolished materials to accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

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

END OF SECTION 024119

SECTION 033053 - MISCELLANEOUS CAST-IN-PLACE CONCRETE

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 cast-in-place concrete, including reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.3 ACTION SUBMITTALS

- A. Other Action Submittal:
 - 1. Design Mixtures: For each concrete mixture.

1.4 QUALITY ASSURANCE

- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- B. Comply with the following sections of **ACI 301 (ACI 301M)**, unless modified by requirements in the Contract Documents:
 - 1. "General Requirements."
 - 2. "Formwork and Formwork Accessories."
 - 3. "Reinforcement and Reinforcement Supports."
 - 4. "Concrete Mixtures."
 - 5. "Handling, Placing, and Constructing."
- C. Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

PART 2 - PRODUCTS

2.1 FORMWORK

- A. Furnish formwork and formwork accessories according to **ACI 301 (ACI 301M)**.

2.2 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from as-drawn steel wire into flat sheets.

2.3 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout Project:
 - 1. Portland Cement: ASTM C 150, Type I.
- B. Normal-Weight Aggregate: ASTM C 33, graded, 1-1/2-inch (38-mm) nominal maximum aggregate size.
- C. Water: ASTM C 94/C 94M.
- D. Synthetic Fiber: Monofilament polypropylene fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches (13 to 38 mm) long.

2.4 RELATED MATERIALS

- A. Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils (0.25 mm) thick; or plastic sheet, ASTM E 1745, Class C.

2.5 CURING MATERIALS

- A. Water: Potable.
- B. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.6 CONCRETE MIXTURES

- A. Comply with ACI 301 (ACI 301M) requirements for concrete mixtures.
- B. Normal-Weight Concrete: Prepare design mixes, proportioned according to ACI 301 (ACI 301M), as follows:
 - 1. Minimum Compressive Strength: 3500 psi (24.1 MPa) at 28 days.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.50.
 - 3. Slump Limit: 5 inches (125 mm), plus or minus 1 inch (25 mm).
 - 4. Air Content: Maintain within range permitted by ACI 301 (ACI 301M). Do not allow air content of trowel-finished floor slabs to exceed 3 percent.

2.7 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
 - 1. When air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, construct, erect, brace, and maintain formwork according to **ACI 301 (ACI 301M)**.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 VAPOR RETARDERS

- A. Install, protect, and repair vapor retarders according to ASTM E 1643; place sheets in position with longest dimension parallel with direction of pour.
 - 1. Lap joints **6 inches (150 mm)** and seal with manufacturer's recommended adhesive or joint tape.

3.4 STEEL REINFORCEMENT

- A. 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.

3.5 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with groover tool to a radius of **1/8 inch (3.2 mm)**. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

- A. Comply with **ACI 301 (ACI 301M)** for placing concrete.
- B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of **ACI 301 (ACI 301M)**.
- C. Do not add water to concrete during delivery, at Project site, or during placement.
- D. Consolidate concrete with mechanical vibrating equipment.

E. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases **4 inches (100 mm)** high unless otherwise indicated; and extend base not less than **6 inches (150 mm)** in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
3. Minimum Compressive Strength: **3500 psi (24.1 MPa)** at 28 days.
4. 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.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.7 FINISHING FORMED SURFACES

- A. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.8 FINISHING UNFORMED SURFACES

- A. General: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on surface.
1. Do not further disturb surfaces before starting finishing operations.
- C. Trowel Finish: Apply a hard trowel finish to surfaces indicated and to floor and slab 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.

3.9 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with **ACI 301 (ACI 301M)** for hot-weather protection during curing.
- B. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- C. Curing Methods: Cure formed and unformed concrete for at least seven days by one or a combination of the following methods:
1. 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.

3.10 REPAIRS

- A. Remove and replace concrete that does not comply with requirements in this Section.

END OF SECTION 033053

SECTION 054000 - COLD-FORMED METAL FRAMING

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. Load-bearing wall framing.
- 2. Floor joist framing.

- B. Related Requirements:

- 1. Section 092216 "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of cold-formed steel framing product and accessory.

1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:

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

- B. Comply with AISI S230 "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. ClarkWestern Building Systems, Inc.
2. Dietrich Metal Framing; a Worthington Industries company.
3. MarinoWARE.
4. Super Stud Building Products, Inc.
5. United Steel Manufacturing.

2.2 PERFORMANCE REQUIREMENTS

- A. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.
- B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.3 COLD-FORMED STEEL FRAMING, GENERAL

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 1. Grade: **ST33H** (ST230H).
 2. Coating: **G60** (ZF180), **A60** (ZF180), **AZ50** (AZ150), or **GF30** (ZGF90).

2.4 LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 1. Minimum Base-Metal Thickness: **0.0428 inch** (1.09 mm).
 2. Flange Width: **1-5/8 inches** (41 mm).
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
 1. Minimum Base-Metal Thickness: Matching steel studs.
 2. Flange Width: **1-1/4 inches** (32 mm).
- C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:
 1. Minimum Base-Metal Thickness: **0.0428 inch** (1.09 mm).
 2. Flange Width: **1-5/8 inches** (41 mm).

2.5 FLOOR JOIST FRAMING

- A. Steel Joists: Manufacturer's standard C-shaped steel joists, of web depths indicated, punched, with stiffened flanges, and as follows:
 1. Minimum Base-Metal Thickness: **0.0428 inch** (1.09 mm).

2. Flange Width: 1-5/8 inches (41 mm), minimum.

B. Steel Joist Track: Manufacturer's standard U-shaped steel joist track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
2. Flange Width: 1-1/2 inches (38 mm), minimum.

2.6 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Anchor clips.
4. End clips.
5. Joist hangers and end closures.

2.7 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.

C. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

D. Welding Electrodes: Comply with AWS standards.

2.8 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B.

B. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.

C. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.9 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by no fewer than three exposed screw threads.
 - 4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies 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. Spacing: 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.
 - 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of **1/8 inch (3 mm)**.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Install load bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than **1/4 inch (6 mm)** to ensure a uniform bearing surface on supporting concrete or masonry construction.
- B. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

- B. Install cold-formed steel framing according to AISI S200 and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding **1/16 inch (1.6 mm)**.
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.
- H. Erection Tolerances: Install cold-formed steel 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.

3.4 LOAD-BEARING WALL INSTALLATION

- A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
 - 1. Anchor Spacing: **32 inches (813 mm)**.
- B. Squarely seat studs against top and bottom tracks with gap not exceeding of **1/8 inch (3 mm)** between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:
 - 1. Stud Spacing: **16 inches (406 mm)**.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

- D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.
- E. Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.
- F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.
- G. 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.
 - 1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
 - 2. 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.
- H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
 - 1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.
- I. Install horizontal bridging in stud system, spaced vertically **48 inches (1220 mm)**. Fasten at each stud intersection.
 - 1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to **6 inches (150 mm)** deep.
- J. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.
- K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 JOIST INSTALLATION

- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.
- B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
 - 1. Install joists over supporting frame with a minimum end bearing of **1-1/2 inches (38 mm)**.
 - 2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.
- C. Space joists not more than **2 inches (51 mm)** from abutting walls, and as follows:

1. Joist Spacing: 16 inches (406 mm).
 - D. Frame openings with built-up joist headers consisting of joist and joist track, or another combination of connected joists if indicated.
 - E. Install bridging at intervals indicated. Fasten bridging at each joist intersection as follows:
 1. Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
 - F. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.
 - G. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.
- 3.6 REPAIRS AND PROTECTION
- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
 - B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 055000 - METAL FABRICATIONS

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. Steel tube reinforcement for low partitions.
2. Steel framing and supports for mechanical and electrical equipment.
3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
4. Metal bollards.
5. Loose bearing and leveling plates for applications where they are not specified in other Sections.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

C. Related Requirements:

1. Section 033053 "Miscellaneous Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Section 042000 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
3. Section 055213 "Pipe and Tube Railings."

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details. Provide Shop Drawings for the following:

1. Steel tube reinforcement for low partitions.
2. Steel framing and supports for mechanical and electrical equipment.
3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
4. Metal bollards.
5. Loose steel lintels.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer.
- B. Mill Certificates: Signed by stainless-steel manufacturers, certifying that products furnished comply with requirements.
- C. Welding certificates.
- D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- E. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.7 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- C. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

- D. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- E. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.
- F. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
- G. Aluminum Plate and Sheet: **ASTM B 209 (ASTM B 209M)**, Alloy 6061-T6.
- H. Aluminum Extrusions: **ASTM B 221 (ASTM B 221M)**, Alloy 6063-T6.

2.2 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or **ASTM F 1941 (ASTM F 1941M)**, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless-steel fasteners for fastening aluminum.
 - 2. Provide stainless-steel fasteners for fastening stainless steel.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, **ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6)**; with hex nuts, **ASTM A 563 (ASTM A 563M)**; and, where indicated, flat washers.
- C. Steel Bolts and Nuts: Regular hexagon-head bolts, **ASTM A 325, Type 3 (ASTM A 325M, Type 3)**; with hex nuts, **ASTM A 563, Grade C3 (ASTM A 563M, Class 8S3)**; and, where indicated, flat washers.
- D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, **ASTM F 593 (ASTM F 738M)**; with hex nuts, **ASTM F 594 (ASTM F 836M)**; and, where indicated, flat washers; Alloy Group **1 (A1)**.
- E. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, **ASTM A 563 (ASTM A 563M)**; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- F. Anchors, General: Anchors capable of sustaining, 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 by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
- G. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- H. Post-Installed Anchors: chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or **ASTM F 1941 (ASTM F 1941M)**, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group **1 (A1)** stainless-steel bolts, **ASTM F 593 (ASTM F 738M)**, and nuts, **ASTM F 594 (ASTM F 836M)**.
- I. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, **1-5/8 by 7/8 inches (41 by 22 mm)** by length indicated with anchor straps or studs not less than

3 inches (75 mm) long at not more than 8 inches (200 mm) o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.3 MISCELLANEOUS MATERIALS

- A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.
- D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- E. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- F. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- H. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- I. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).

2.4 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, **1/8 by 1-1/2 inches (3.2 by 38 mm)**, with a minimum **6-inch (150-mm)** embedment and **2-inch (50-mm)** hook, not less than **8 inches (200 mm)** from ends and corners of units and **24 inches (600 mm)** o.c., unless otherwise indicated.

2.5 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
1. Fabricate units from slotted channel framing where indicated.
 2. Furnish inserts for units installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.
- D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.6 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Galvanize exterior miscellaneous steel trim.

2.7 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 40 steel pipe steel shapes, as indicated.
- B. Fabricate bollards with **3/8-inch- (9.5-mm-)** thick steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for **3/4-inch (19-mm)** anchor bolts.
 - 1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.

2.8 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize plates.

2.9 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than **8 inches (200 mm)** unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.

2.10 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.11 FINISHES, GENERAL

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.12 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

- C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with universal shop primer unless zinc-rich primer is indicated.
- D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning." requirements indicated below:
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 4. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.13 ALUMINUM FINISHES

- A. As-Fabricated Finish: AA-M12.
- B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 - 1. Cast Aluminum: Heavy coat of bituminous paint.
 - 2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.3 INSTALLING METAL BOLLARDS

- A. Anchor bollards to existing construction with expansion anchors. Provide four **3/4-inch (19-mm)** bolts at each bollard unless otherwise indicated.
 - 1. Embed anchor bolts at least **4 inches (100 mm)** in concrete.
- B. Fill bollards solidly with concrete, mounding top surface to shed water.
 - 1. Do not fill removable bollards with concrete.

3.4 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum **2.0-mil (0.05-mm)** dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055000

SECTION 055100 - METAL STAIRS

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. Preassembled steel stairs with concrete-filled treads.

- B. Related Sections:

- 1. Section 033053 "Miscellaneous Cast-in-Place Concrete" for concrete fill for stair treads and platforms.
- 2. Section 061000 "Rough Carpentry" for wood blocking for anchoring railings.
- 3. Section 092216 "Non-Structural Metal Framing" for metal backing for anchoring railings.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design metal stairs, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

- B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

- 1. Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
- 2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
- 3. Uniform and concentrated loads need not be assumed to act concurrently.
- 4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
- 5. Limit deflection of treads, platforms, and framing members to L/240 or 1/4 inch (6.4 mm), whichever is less.

1.4 ACTION SUBMITTALS

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

- B. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.
 - 1. Preassembled Stairs: Commercial class.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513.
- C. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, **Grade 25 (Grade 170)**, unless another grade is required by design loads; exposed.

2.3 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or **ASTM F 1941 (ASTM F 1941M)**, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, **ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6)**; with hex nuts, **ASTM A 563 (ASTM A 563M)**; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, **ASTM A 563 (ASTM A 563M)**; and, where indicated, flat washers.
- D. Machine Screws: **ASME B18.6.3 (ASME B18.6.7M)**.
- E. Lag Screws: **ASME B18.2.1 (ASME B18.2.3.8M)**.
- F. Plain Washers: Round, **ASME B18.22.1 (ASME B18.22M)**.
- G. Lock Washers: Helical, spring type, **ASME B18.21.1 (ASME B18.21.2M)**.
- H. Post-Installed Anchors: chemical anchors capable of sustaining, 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 by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or **ASTM F 1941 (ASTM F 1941M)**, Class Fe/Zn 5, unless otherwise indicated.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Concrete Materials and Properties: Comply with requirements in Section 033053 "Miscellaneous 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.

2.5 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 - 1. Join components by welding unless otherwise indicated.
 - 2. Use connections that maintain structural value of joined pieces.
- B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately **1/32 inch (1 mm)** unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Weld exposed corners and seams continuously unless otherwise indicated.
 - 5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 2 welds: completely sanded joint, some undercutting and pinholes okay.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.
- H. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.6 STEEL-FRAMED STAIRS

- A. Stair Framing:
 - 1. Fabricate stringers of steel channels.
 - a. Provide closures for exposed ends of channel stringers.
 - 2. Construct platforms of steel plate or channel headers and miscellaneous framing members as needed to comply with performance requirements indicated.
 - 3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.
 - 4. Where stairs are enclosed by gypsum board assemblies, provide hanger rods or struts to support landings from floor construction above or below. Locate hanger rods and struts where they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.
 - 5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
- B. Metal-Pan Stairs: Form risers, subreads pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than **0.067 inch (1.7 mm)**.
 - 1. Steel Sheet: Uncoated cold-rolled steel sheet unless otherwise indicated.
 - 2. Directly weld metal pans to stringers; locate welds on top of subreads where they will be concealed by concrete fill. Do not weld risers to stringers.
 - 3. Shape metal pans to include nosing integral with riser.
 - 4. At Contractor's option, provide stair assemblies with metal-pan subreads filled with reinforced concrete during fabrication.

5. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.
 - a. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.

2.7 STAIR RAILINGS

- A. Comply with applicable requirements in Section 055213 "Pipe and Tube Railings."
- B. Steel Tube Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.
 1. Rails and Posts: **1-5/8-inch- (41-mm-)** diameter top and bottom rails and **1-1/2-inch- (38-mm-)** square posts.
 2. Intermediate Rails Infill: **1-5/8-inch- (41-mm-)** diameter intermediate rails spaced less than **21 inches (533 mm)** clear.
- C. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 1. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 2 welds: completely sanded joint, some undercutting and pinholes okay.
- D. Form changes in direction of railings as follows:
 1. By bending.
 2. By flush bends.
 3. By radius bends of radius indicated.
- E. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- F. Close exposed ends of railing members with prefabricated end fittings.
- G. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is **1/4 inch (6 mm)** or less.
- H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
 1. Connect posts to stair framing by direct welding unless otherwise indicated.
 2. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.
- I. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.8 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal stairs after assembly.
- C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning." minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products:
 - 1. Interior Stairs: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Interior Stairs: SSPC-SP 3, "Power Tool Cleaning."
- D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- F. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.
- G. Place and finish concrete fill for treads and platforms to comply with Section 033000 "Cast-in-Place Concrete."

3.2 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

END OF SECTION 055100

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Steel pipe and tube railings.
- B. Related Requirements:
 - 1. Section 055112 "Metal Pan Stairs" for steel tube railings associated with metal pan stairs.

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Manufacturer's product lines of mechanically connected railings.
 - 2. Railing brackets.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Evaluation Reports: For post-installed anchors , from ICC-ES.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

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

1.8 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
 - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C, material surfaces).

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch (38-mm) clearance from inside face of handrail to finished wall surface.

2.3 STEEL AND IRON

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

- B. Tubing: ASTM A 500 (cold formed) or ASTM A 513.
- C. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
 - 1. Provide galvanized finish for exterior installations and where indicated.
- D. Plates, Shapes, and Bars: ASTM A 36/A 36M.
- E. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.4 FASTENERS

- A. General: Provide the following:
 - 1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or **ASTM F 1941 (ASTM F 1941M)**, Class Fe/Zn 5 for zinc coating.
 - 2. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.
 - 3. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Post-Installed Anchors: chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
 - 1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or **ASTM F 1941 (ASTM F 1941M)**, Class Fe/Zn 5, unless otherwise indicated.

2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Intermediate Coats and Topcoats: Provide products that comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

2.6 FABRICATION

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

- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately **1/32 inch (1 mm)** unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - 1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
- J. Form Changes in Direction as Follows:
 - 1. As detailed.
 - 2. By bending.
 - 3. By flush bends.
 - 4. By radius bends of radius indicated.
- K. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- L. Close exposed ends of railing members with prefabricated end fittings.
- M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is **1/4 inch (6 mm)** or less.
- N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

- O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- P. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.7 STEEL AND IRON FINISHES

- A. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, galvanize anchors to be embedded in exterior concrete or masonry.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning." requirements indicated below:
 - 1. Other Railings: SSPC-SP 3, "Power Tool Cleaning."
- C. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
 - 1. Shop prime uncoated railings with universal shop primer unless zinc-rich primer is indicated.
 - 2. Do not apply primer to galvanized surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 2. Set posts plumb within a tolerance of **1/16 inch in 3 feet (2 mm in 1 m)**.
 - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed **1/4 inch in 12 feet (6 mm in 3.5 m)**.
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
 - 1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.

- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.
- C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches (50 mm) beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches (150 mm) of post.

3.4 ATTACHING RAILINGS

- A. Anchor railing ends at walls with round flanges anchored to wall construction and welded to railing ends.
- B. Attach railings to wall with wall brackets, except where end flanges are used. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- C. Secure wall brackets and railing end flanges to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.
 - 3. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.

3.5 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

3.6 PROTECTION

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

END OF SECTION 055213

SECTION 061000 - ROUGH CARPENTRY

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. Framing with dimension lumber.
 - 2. Wood blocking and nailers.
 - 3. Plywood backing panels.

1.3 DEFINITIONS

- A. Exposed Framing: Framing not concealed by other construction.
- B. Dimension Lumber: Lumber of **2 inches nominal (38 mm actual)** or greater but less than **5 inches nominal (114 mm actual)** in least dimension.
- C. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. NeLMA: Northeastern Lumber Manufacturers' Association.
 - 2. NLGA: National Lumber Grades Authority.
 - 3. WCLIB: West Coast Lumber Inspection Bureau.
 - 4. WWPAA: Western Wood Products Association.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - 3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically

performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSB Board of Review. Provide lumber graded by an agency certified by the ALSB Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
 - 3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 - 4. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal (38-mm actual) thickness or less, 19 percent for more than 2-inch nominal (38-mm actual) thickness, unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
 - 2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSB Board of Review.
 - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
- D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 DIMENSION LUMBER FRAMING

- A. Load-Bearing Partitions: Construction or No. 2 grade.
1. Application: Exterior walls.
 2. Species:
 - a. Spruce-pine-fir; NLGA.
- B. Joists, Rafters, and Other Framing Not Listed Above: Construction or No. 2 grade.
1. Species:
 - a. Spruce-pine-fir; NLGA.
- C. Exposed Framing: Provide material hand-selected for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.
1. Application: Exposed interior framing indicated to receive a stained or natural finish.
 2. Species and Grade: Spruce-pine-fir; No. 1 grade; NLGA.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
1. Blocking.
 2. Nailers.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber and any of the following species:
1. Spruce-pine-fir; NLGA.
 2. Eastern softwoods; NeLMA.
- C. For concealed boards, provide lumber with 15 percent maximum moisture content and the following species and grades:
1. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
- D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

- E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.5 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: DOC PS 1, Exterior, C-C Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than **3/4-inch (19-mm)** nominal thickness.

2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Lag Bolts: **ASME B18.2.1 (ASME B18.2.3.8M)**.
- E. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2.7 METAL FRAMING ANCHORS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Simpson Strong-Tie Co., Inc.
- B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those of basis-of-design products. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, **G60 (Z180)** coating designation.
 - 1. Use for interior locations unless otherwise indicated.

2.8 MISCELLANEOUS MATERIALS

- A. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chlorpyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- C. Do not splice structural members between supports unless otherwise indicated.
- D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than **16 inches (406 mm)** o.c.
- E. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than **96 inches (2438 mm)** o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 - 2. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than **100 sq. ft. (9.3 sq. m)** and to solidly fill space below partitions.
 - 3. Fire block concealed spaces behind combustible cornices and exterior trim at not more than **20 feet (6 m)** o.c.
- F. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- G. Comply with AWWA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- H. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
- I. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.
- J. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
 - 1. Comply with approved fastener patterns where applicable.

2. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.
3. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

3.2 WALL AND PARTITION FRAMING INSTALLATION

- A. General: Provide single bottom plate and double top plates using members of 2-inch nominal (38-mm actual) thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions. Fasten plates to supporting construction unless otherwise indicated.
- B. Construct corners and intersections with three or more studs.
- C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.

3.3 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes sufficiently wet that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 061600 - SHEATHING

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. Wall sheathing.
- B. Related Requirements:
 - 1. Section 061000 "Rough Carpentry" for plywood backing panels.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - 3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS

- A. Plywood: DOC PS 1.
- B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- C. Factory mark panels to indicate compliance with applicable standard.

2.2 PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.3 WALL SHEATHING

- A. Plywood Wall Sheathing: Exterior, Structural I sheathing.
 - 1. Span Rating: Not less than 16/0.
 - 2. Nominal Thickness: Not less than 19/32 inch (14.7 mm).

2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
 - 1. For wall and roof sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

2.5 MISCELLANEOUS MATERIALS

- A. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
- D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- E. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
 - 1. Wall and Roof Sheathing:
 - a. Nail to wood framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.
 - b. Screw to cold-formed metal framing.
 - c. Space panels **1/8 inch (3 mm)** apart at edges and ends.

END OF SECTION 061600

SECTION 064116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Plastic-laminate-faced architectural cabinets.

- B. Related Requirements:

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

1.3 ACTION SUBMITTALS

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

- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

- 1. Show details full size.
- 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
- 3. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural plastic-laminate cabinets.

- C. Samples for Initial Selection:

- 1. Plastic laminates.
- 2. PVC edge material.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

- B. Installer Qualifications: Fabricator of products.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 43 and 70 percent during the remainder of the construction period.
- C. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.
- D. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 COORDINATION

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

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
 - 1. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.
- B. Grade: Premium.
- C. Type of Construction: Frameless.
- D. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Abet Laminati, Inc.
 - b. Formica Corporation.
 - c. Lamin-Art, Inc.
 - d. Panolam Industries International, Inc.
 - e. Wilsonart International; Div. of Premark International, Inc.

F. Laminate Cladding for Exposed Surfaces:

1. Horizontal Surfaces: Grade HGS.
2. Vertical Surfaces: Grade HGS.
3. Edges: PVC T-mold matching laminate in color, pattern, and finish.
4. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.

G. Materials for Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade CLS.
 - a. Edges of Plastic-Laminate Shelves: PVC tape, 0.018-inch (0.460-mm) minimum thickness, matching laminate in color, pattern, and finish.
 - b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade CLS.
2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.
3. Drawer Bottoms: Hardwood plywood.

H. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.

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

1. As indicated by laminate manufacturer's designations.

2.2 WOOD MATERIALS

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

1. Wood Moisture Content: 5 to 10 percent.

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

1. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.

2.3 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087111 "Door Hardware (Descriptive Specification)."
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening, self-closing.
- C. Wire Pulls: Back mounted, solid metal, **4 inches (100 mm)** long, **5/16 inch (8 mm)** in diameter.
- D. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.
- E. Drawer Slides: BHMA A156.9.
 - 1. Grade 1 and Grade 2: Side mounted and extending under bottom edge of drawer; full-extension type; zinc-plated steel with polymer rollers.
 - 2. For drawers not more than **3 inches (75 mm)** high and not more than **24 inches (600 mm)** wide, provide Grade 2.
- F. Door and Drawer Silencers: BHMA A156.16, L03011.
- G. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
 - 2. Bright Chromium Plated: BHMA 625 for brass or bronze base; BHMA 651 for steel base.
 - 3. Satin Stainless Steel: BHMA 630.
- H. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.4 MISCELLANEOUS MATERIALS

- A. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
 - 1. Adhesive for Bonding Edges: Hot-melt adhesive.

2.5 FABRICATION

- A. Fabricate cabinets to dimensions, profiles, and details indicated.
- B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
 - 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.

- C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.
- B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

3.2 INSTALLATION

- A. Grade: Install cabinets to comply with same grade as item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.
- C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of **1/8 inch in 96 inches (3 mm in 2400 mm)**.
- D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
 - 1. Use filler matching finish of items being installed.
- F. Cabinets: Install without distortion so 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 installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than **1/8 inch in 96-inch (3 mm in 2400-mm)** sag, bow, or other variation from a straight line.
 - 2. Fasten wall cabinets through back, near top and bottom, and at ends not more than **16 inches (400 mm)** o.c. with No. 10 wafer-head screws sized for not less than **1-1/2-inch (38-mm)** penetration into wood framing, blocking, or hanging strips.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION 064116

SECTION 070150.19 - PREPARATION FOR REROOFING

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. Full tear-off of roof areas indicated.

- B. Related Requirements:

- 1. Section 011000 "Summary" for use of the premises and phasing requirements.
- 2. Section 015000 "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for reroofing preparation.

1.3 UNIT PRICES

- A. Work of this Section is affected by roof purlin removal and replacement unit prices.

1.4 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.
- B. Full Roof Tear-Off: Removal of existing roofing system from existing support purlins and framing.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include plans, sections, and details.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
 - 1. Include certificate that Installer is approved by warrantor of existing roofing system.
 - 2. Include certificate that Installer is licensed to perform asbestos abatement.
- B. Fastener pull-out test report.

- C. Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including exterior and interior finish surfaces, that might be misconstrued as having been damaged by reroofing operations. Submit before Work begins.
- D. Landfill Records: Indicate receipt and acceptance of demolished roofing materials by a landfill facility licensed to accept them.

1.7 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning roofing removal. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Reroofing Conference: Conduct conference at Project site.
 - 1. Meet with Owner; Architect; Owner's insurer if applicable; testing and inspecting agency representative; roofing system manufacturer's representative; roofing Installer, including project manager, superintendent, and foreman; and installers whose work interfaces with or affects reroofing, including installers of roof deck, roof accessories, and roof-mounted equipment.
 - 2. Review methods and procedures related to roofing system tear-off and replacement, including, but not limited to, the following:
 - a. Reroofing preparation, including roofing system manufacturer's written instructions.
 - b. Temporary protection requirements for existing roofing system components that are to remain.
 - c. Construction schedule and availability of materials, Installer's personnel, equipment, and facilities needed to avoid delays.
 - d. Existing roof purlin and framing conditions requiring notification of Architect.
 - e. Existing roof purlin and framing removal procedures and Owner notifications.
 - f. Condition and acceptance of existing roof framing and base flashing substrate for reuse.
 - g. Structural loading limitations of roof deck during reroofing.
 - h. Base flashings, special roofing details, drainage, penetrations, equipment curbs, and condition of other construction that affect reroofing.
 - i. Governing regulations and requirements for insurance and certificates if applicable.
 - j. Existing conditions that may require notification of Architect before proceeding.

1.8 FIELD CONDITIONS

- A. Existing Roofing System: Formed metal roofing.
- B. Protect building to be reroofed, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.
- C. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
- D. Conditions existing at time of inspection for bidding are maintained by Owner as far as practical.
- E. Weather Limitations: Proceed with reroofing preparation only when existing and forecasted weather conditions permit Work to proceed without water entering existing roofing system or building.
 - 1. Remove only as much roofing in one day as can be made watertight in the same day.
- F. Hazardous Materials: It is not expected that hazardous materials, such as asbestos-containing materials, will be encountered in the Work.

1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 PREPARATION

- A. Shut off rooftop utilities and service piping before beginning the Work.
- B. Protect existing roofing system that is not to be reroofed.
 1. Loosely lay **1-inch- (25-mm-)** minimum thick, expanded polystyrene (EPS) insulation over existing roofing in areas indicated. Loosely lay **15/32-inch (12-mm)** plywood or OSB panels over EPS. Extend EPS past edges of plywood or OSB panels a minimum of **1 inch (25 mm)**.
 2. Limit traffic and material storage to areas of existing roofing that have been protected.
 3. Maintain temporary protection and leave in place until replacement roofing has been completed. Remove temporary protection on completion of reroofing.
- C. Coordinate with Owner to shut down air-intake equipment in the vicinity of the Work. Cover air-intake louvers before proceeding with reroofing work that could affect indoor air quality or activate smoke detectors in the ductwork.
- D. During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.

3.2 ROOF TEAR-OFF

- A. General: Notify Owner each day of extent of roof tear-off proposed for that day.
- B. Full Roof Tear-Off: Where indicated, remove existing roofing and other roofing system components down to the roof purlins and framing.
 1. Remove wood blocking, curbs, and nailers.
 2. Remove fasteners from purlins and framing.

3.3 DECK PREPARATION

- A. Inspect purlins and framing after tear-off of roofing system.
- B. If broken or loose fasteners that secure deck panels to one another or to structure are observed, or if deck appears or feels inadequately attached, immediately notify Architect. Do not proceed with installation until directed by Architect.
- C. If purlins or framing member surface is unsuitable for receiving new roofing or if structural integrity of framing is suspect, immediately notify Architect. Do not proceed with installation until directed by Architect.

3.4 FASTENER PULL-OUT TESTING

- A. Perform fastener pull-out tests according to SPRI FX-1, and submit test report to roofing manufacturer before installing new roofing system.
 - 1. Obtain roofing manufacturer's approval to proceed with specified fastening pattern. Roofing manufacturer may furnish revised fastening pattern commensurate with pull-out test results.

3.5 DISPOSAL

- A. Collect demolished materials and place in containers. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
 - 1. Storage or sale of demolished items or materials on-site is not permitted.
- B. Transport and legally dispose of demolished materials off Owner's property.

END OF SECTION 070150.19

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Glass-fiber blanket insulation.

1.3 ACTION SUBMITTALS

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

1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.1 GLASS-FIBER BLANKET INSULATION

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. CertainTeed Corporation.
 - 2. Guardian Building Products, Inc.
 - 3. Johns Manville.
 - 4. Knauf Insulation.
 - 5. Owens Corning.
- B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

- C. 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.
- D. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:
 - 1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
 - 2. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.2 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Glass-Fiber Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain **3-inch (76-mm)** clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
 - 5. For metal-framed wall cavities where cavity heights exceed **96 inches (2438 mm)**, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

END OF SECTION 072100

SECTION 074113.13 - FORMED METAL ROOF PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Exposed-fastener, lap-seam, metal roof panels.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of roof accessories and roof-mounted equipment.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
 - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - 5. Review structural loading limitations of purlins and rafters during and after roofing.
 - 6. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.
 - 7. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 - 8. Review temporary protection requirements for metal panel systems during and after installation.
 - 9. Review procedures for repair of metal panels damaged after installation.
 - 10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

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 each type of panel and accessory.
- B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
 2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than **1-1/2 inches per 12 inches (1:10)**.
- C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.
1. Include similar Samples of trim and accessories involving color selection.
- 1.5 INFORMATIONAL SUBMITTALS
- A. Sample Warranties: For special warranties.
- 1.6 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For metal panels to include in maintenance manuals.
- 1.7 QUALITY ASSURANCE
- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
 - B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.
- 1.8 DELIVERY, STORAGE, AND HANDLING
- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
 - B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
 - C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
 - D. Retain strippable protective covering on metal panels during installation.
- 1.9 FIELD CONDITIONS
- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.
- 1.10 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.
- B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
 - 1. Wind Loads: 90 mph wind in accordance with ASCE 7.
 - 2. Other Design Loads: 25 pound per square foot ground snow load.
 - 3. Deflection Limits: For wind loads, no greater than 1/240 of the span.
- B. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
 - 1. Uplift Rating: UL 90.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

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

2.2 EXPOSED-FASTENER, LAP-SEAM, METAL ROOF PANELS

- A. General: Provide factory-formed metal roof panels designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.
- B. Corrugated-Profile, Exposed-Fastener Metal Roof Panels: Formed with alternating curved ribs spaced at 2.67 inches (68 mm) o.c. across width of panel.
 1. Basis-of-Design: MBCI; A division of NCI Building Systems, L.P.: PBC Panel.
 2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Alcoa Inc.
 - b. CENTRIA Architectural Systems.
 - c. Firestone Metal Products, LLC.
 - d. MBCI; a division of NCI Building Systems, L.P.
 - e. Union Corrugating Company.
 3. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Nominal Thickness: 0.022 inch (0.56 mm).
 - b. Exterior Finish: Two-coat fluoropolymer.
 - c. Color: As selected by Architect from manufacturer's full range of standard colors.
 4. Panel Coverage: 34.67 inches (881 mm).
 5. Panel Height: 0.875 inch (22 mm).

2.3 MISCELLANEOUS MATERIALS

- A. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
 1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
 2. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- B. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

- C. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- D. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
 - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape **1/2 inch (13 mm)** wide and **1/8 inch (3 mm)** thick.
 - 2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.

2.4 FABRICATION

- A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 - 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

2.5 FINISHES

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

- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Steel Panels and Accessories:
 - 1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
 - 1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
 - 2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 METAL PANEL INSTALLATION

- A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving metal panels.
 - 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air or water-resistive barriers and flashings that are concealed by metal panels are installed.
 - 3. Install screw fasteners in predrilled holes.
 - 4. Locate and space fasteners in uniform vertical and horizontal alignment.
 - 5. Install flashing and trim as metal panel work proceeds.

6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
 2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
 3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
 4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
 5. Flash and seal panels with weather closures at perimeter of all openings.
 6. Watertight Installation:
 - a. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels and elsewhere as needed to make panels watertight.
 - b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
 - c. At panel splices, nest panels with minimum **6-inch (152-mm)** end lap, sealed with sealant and fastened together by interlocking clamping plates.
- E. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended in writing by metal panel manufacturer.
- F. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that are permanently watertight.
1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of **10 feet (3 m)** with no joints allowed within **24 inches (610 mm)** of corner or intersection. Where lapped expansion provisions cannot be used or would not be

sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than **1 inch (25 mm)** deep, filled with mastic sealant (concealed within joints).

- G. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.4 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal panel units within installed tolerance of **1/4 inch in 20 feet (6 mm in 6 m)** on slope and location lines and within **1/8-inch (3-mm)** offset of adjoining faces and of alignment of matching profiles.

3.5 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074113.13

SECTION 074113.16 - STANDING-SEAM METAL ROOF PANELS (ALTERNATE 1)

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 standing-seam metal roof panels.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of roof accessories and roof-mounted equipment.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
 - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - 5. Review structural loading limitations of purlins and rafters during and after roofing.
 - 6. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.
 - 7. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 - 8. Review temporary protection requirements for metal panel systems during and after installation.
 - 9. Review procedures for repair of metal panels damaged after installation.
 - 10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

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 each type of panel and accessory.
- B. Shop Drawings:
 - 1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches (1:10).

C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

1.5 INFORMATIONAL SUBMITTALS

- A. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.10 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

- B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.
- C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
 - 1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
 - 1. Wind Loads: 90 mph wind in accordance with ASCE 7.
 - 2. Other Design Loads: 25 pound per square foot ground snow load.
 - 3. Deflection Limits: For wind loads, no greater than 1/240 of the span.
- B. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
 - 1. Uplift Rating: UL 90.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of

connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

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

2.2 STANDING-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.

1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.

B. Vertical-Rib, Snap-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and snapping panels together.

1. Basis-of-Design: CENTRIA Architectural Systems, SDP 200 structural standing seam metal roof system.
2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Advanced Architectural Products.
 - b. CENTRIA Architectural Systems.
 - c. Dimensional Metals, Inc.
 - d. MBCI; a division of NCI Building Systems, L.P.
 - e. Petersen Aluminum Corporation.
3. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Nominal Thickness: 0.022 inch (0.56 mm).
 - b. Exterior Finish: Two-coat fluoropolymer.
 - c. Color: As selected by Architect from manufacturer's full range.
4. Clips: Two-piece floating to accommodate thermal movement.
 - a. Material: 0.064-inch- (1.63-mm-) nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
5. Panel Coverage: 16 inches (406 mm).
6. Panel Height: 2 inches (50.8 mm).

2.3 MISCELLANEOUS MATERIALS

- A. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
 - 1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
 - 2. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum **1-inch- (25-mm-)** thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- B. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- C. Panel Fasteners: Self-tapping screws designed to withstand design loads.
- D. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
 - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape **1/2 inch (13 mm)** wide and **1/8 inch (3 mm)** thick.
 - 2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.

2.4 FABRICATION

- A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.

4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

2.5 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Steel Panels and Accessories:
 1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
 1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
 2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 METAL PANEL INSTALLATION

- A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Shim or otherwise plumb substrates receiving metal panels.
 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 3. Install screw fasteners in predrilled holes.
 4. Locate and space fasteners in uniform vertical and horizontal alignment.
 5. Install flashing and trim as metal panel work proceeds.
 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
- C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.
- D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.
1. Install clips to supports with self-tapping fasteners.
 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
 4. Watertight Installation:
 - a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommend in writing by manufacturer as needed to make panels watertight.
 - b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
 - c. At panel splices, nest panels with minimum **6-inch (152-mm)** end lap, sealed with sealant and fastened together by interlocking clamping plates.
- F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.

- G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of **10 feet (3 m)** with no joints allowed within **24 inches (610 mm)** of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than **1 inch (25 mm)** deep, filled with mastic sealant (concealed within joints).
- H. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.4 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal panel units within installed tolerance of **1/4 inch in 20 feet (6 mm in 6 m)** on slope and location lines as indicated and within **1/8-inch (3-mm)** offset of adjoining faces and of alignment of matching profiles.

3.5 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074113.16

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Penetrations in fire-resistance-rated walls.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.
- B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
 - 1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
 - a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
 - b. Classification markings on penetration firestopping correspond to designations listed by the following:
 - 1) UL in its "Fire Resistance Directory."

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.
- C. Notify Owner's testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Grace Construction Products.
 - 2. Hilti, Inc.
 - 3. Johns Manville.
 - 4. 3M Fire Protection Products.
 - 5. Tremco, Inc.; Tremco Fire Protection Systems Group.
 - 6. USG Corporation.

2.2 PENETRATION FIRESTOPPING

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
- B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
 - 1. Fire-resistance-rated walls include fire-barrier walls.
 - 2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration

firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-wool-fiber or rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board.
 - d. Fillers for sealants.
2. Steel sleeves.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:
 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

- A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

3.4 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

3.5 PENETRATION FIRESTOPPING SCHEDULE

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.
- B. Firestopping for Metallic Pipes, Conduit, or Tubing:
 - 1. UL-Classified Systems: W-L- 1001.
 - 2. UL-Classified Systems: W-L-1003 where sleeve specified or indicated.
- C. Firestopping for Miscellaneous Electrical Penetrants:
 - 1. UL-Classified Systems: W-L- 1001.

END OF SECTION 078413

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Latex joint sealants.

- B. Related Sections:

1. Section 088000 "Glazing" for glazing sealants.
2. Section 092900 "Gypsum Board" for sealing perimeter joints.

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
- B. Field-Adhesion Test Reports: For each sealant application tested.
- C. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

1.6 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
 2. When joint substrates are wet.
 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

- A. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.
 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- C. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- D. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

- A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Dow Corning Corporation; 790.
- b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
- c. May National Associates, Inc.; Bondaflex Sil 728 NS.
- d. Pecora Corporation; 311 NS.
- e. Sika Corporation, Construction Products Division; SikaSil-C990.
- f. Tremco Incorporated; Spectrem 1.

2.3 URETHANE JOINT SEALANTS

- A. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Sika Corporation, Construction Products Division; Sikaflex - 15LM.
 - b. Tremco Incorporated; Dymonic FC.
- B. Single-Component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920. Type S, Grade NS, Class 25, for Use T.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Building Systems; Sonolastic NP1.
 - b. May National Associates, Inc.; Bondaflex PUR 40 FC.
 - c. Pacific Polymers International, Inc.; Elasto-Thane 230 Type II.
 - d. Sika Corporation, Construction Products Division; Sikaflex - 1a.
 - e. Tremco Incorporated; Vulkem 116.

2.4 LATEX JOINT SEALANTS

- A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Building Systems; Sonolac.
 - b. Bostik, Inc.; Chem-Calk 600.
 - c. May National Associates, Inc.; Bondaflex Sil-A 700.
 - d. Pecora Corporation; AC-20+.
 - e. Schnee-Morehead, Inc.; SM 8200.
 - f. Tremco Incorporated; Tremflex 834.

2.5 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that 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. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - d. Exterior insulation and finish systems.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.

- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 1. Remove excess sealant from surfaces adjacent to joints.

2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 CLEANING

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

3.5 PROTECTION

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

3.6 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
 1. Joint Locations:
 - a. Joints between metal panels.
 - b. Perimeter joints between materials listed above and frames of doors, windows and louvers.
 2. Silicone Joint Sealant: Single component, nonsag, neutral curing, Class 100/50.
 3. Urethane Joint Sealant: Single component, nonsag, Class 100/50.
 4. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
 1. Joint Locations:
 - a. Perimeter joints of exterior openings where indicated.
 - b. Vertical joints on exposed surfaces of walls and partitions.
 - c. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
 2. Joint Sealant: Latex.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes hollow-metal work.
- B. Related Requirements:
 - 1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, joints, field splices, and connections.
 - 7. Details of accessories.
 - 8. Details of moldings, removable stops, and glazing.
 - 9. Details of conduit and preparations for power, signal, and control systems.

1.6 INFORMATIONAL SUBMITTALS

- A. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 - 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum **4-inch (102-mm)** high wood blocking. Provide minimum **1/4-inch (6-mm)** space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ceco Door Products; an Assa Abloy Group company.
 - 2. Curries Company; an Assa Abloy Group company.
 - 3. Republic Doors and Frames.
 - 4. Steelcraft; an Ingersoll-Rand company.
- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 INTERIOR DOORS AND FRAMES

- A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2..
 - 1. Physical Performance: Level B according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: **1-3/4 inches (44.5 mm)**.
 - c. Face: Metallic-coated, cold-rolled steel sheet, minimum thickness of **0.042 inch (1.0 mm)**.
 - d. Edge Construction: Model 2, Seamless.
 - e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
 - 3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of **0.053 inch (1.3 mm)**.

b. Construction: Slip-on drywall.

4. Exposed Finish: Prime.

2.3 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than **0.042 inch (1.0 mm)** thick, with corrugated or perforated straps not less than **2 inches (51 mm)** wide by **10 inches (254 mm)** long; or wire anchors not less than **0.177 inch (4.5 mm)** thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than **0.042 inch (1.0 mm)** thick.

B. Floor Anchors: Formed from same material as frames, minimum thickness of **0.042 inch (1.0 mm)**, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.4 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), **04Z (12G)** coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

G. Grout: ASTM C 476, except with a maximum slump of **4 inches (102 mm)**, as measured according to ASTM C 143/C 143M.

H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

I. Glazing: Comply with requirements in Section 088000 "Glazing."

J. Bituminous Coating: Cold-applied asphalt mastic, compounded for **15-mil (0.4-mm)** dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.5 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
1. Vertical Edges for Single-Acting Doors: Provide beveled or square edges at manufacturer's discretion.
 2. Top Edge Closures: Close top edges of doors with inverted closures, except provide flush closures at exterior doors of same material as face sheets.
 3. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 2. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
 3. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 16 inches (406 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c., to match coursing, and as follows:
 - 1) Two anchors per jamb up to 60 inches (1524 mm) high.
 - 2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - 3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
 - 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches (1524 mm) high.
 - 2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - 3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
 4. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
 - 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 - 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
- F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 - 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
 - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 - 4. Provide loose stops and moldings on inside of hollow-metal work.
 - 5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.6 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - b. Install door silencers in frames before grouting.
 - c. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - d. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - e. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 5. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus **1/16 inch (1.6 mm)**, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus **1/16 inch (1.6 mm)**, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus **1/16 inch (1.6 mm)**, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus **1/16 inch (1.6 mm)**, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Steel Doors:
 - a. Between Door and Frame Jambs and Head: **1/8 inch (3.2 mm)** plus or minus **1/32 inch (0.8 mm)**.
 - b. Between Edges of Pairs of Doors: **1/8 inch (3.2 mm)** to **1/4 inch (6.3 mm)** plus or minus **1/32 inch (0.8 mm)**.
 - c. At Bottom of Door: **3/4 inch (19.1 mm)** plus or minus **1/32 inch (0.8 mm)**.
 - d. Between Door Face and Stop: **1/16 inch (1.6 mm)** to **1/8 inch (3.2 mm)** plus or minus **1/32 inch (0.8 mm)**.

- D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.
 - 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than **9 inches (230 mm)** o.c. and not more than **2 inches (51 mm)** o.c. from each corner.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

SECTION 083313 - COILING COUNTER DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Counter doors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type and size of coiling counter door and accessory.

- 1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.

- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

- 1. Include plans, elevations, sections, and mounting details.
- 2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
- 3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For coiling counter doors to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

- 1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

- A. Source Limitations: Obtain coiling counter doors from single source from single manufacturer.
 - 1. Obtain operators and controls from coiling counter door manufacturer.

2.2 COUNTER DOOR ASSEMBLY

- A. Counter Door: Coiling counter door formed with curtain of interlocking metal slats.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Alpine Overhead Doors, Inc.
 - b. Clopay Building Products.
 - c. Cornell Iron Works, Inc.
 - d. Overhead Door Corporation.
 - e. Raynor.
 - f. Wayne-Dalton Corp.
- B. Operation Cycles: Door components and operators capable of operating for not less than 10,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
- C. Door Curtain Material: Aluminum.
- D. Door Curtain Slats: Curved profile slats of Manufacturer's standard slat height but not greater than 2-inches center-to-center height.
 - 1. Insulated-Slat Interior Facing: Metal.
 - 2. Gasket Seal. Manufacturer's standard continuous gaskets between slats.
- E. Bottom Bar: Manufacturer's standard continuous channel or tubular shape, fabricated aluminum extrusion and finished to match door.
- F. Curtain Jamb Guides: Aluminum with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.
- G. Integral Frame, Hood, and Fascia: Galvanized steel.
 - 1. Mounting: Between jambs.
- H. Sill Configuration: No sill.
- I. Locking Devices: Equip door with locking device assembly.
 - 1. Locking Device Assembly: Single-jamb side locking bars, operable from.
- J. Manual Door Operator: Push-up operation.
- K. Curtain Accessories: Equip door with push/pull handles.
- L. Door Finish:
 - 1. Aluminum Finish: Clear anodized.
 - 2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.3 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate coiling counter-door curtain of interlocking metal slats in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
1. Aluminum Door Curtain Slats: **ASTM B 209 (ASTM B 209M)** sheet or **ASTM B 221 (ASTM B 221M)** extrusions, alloy and temper standard with manufacturer for type of use and finish indicated; thickness of **0.050 inch (1.27 mm)**; and as required.
 2. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.
- B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent over-travel of curtain.
1. Removable Posts and Jamb Guides: Manufacturer's standard.

2.4 HOODS

- A. Integral Frame, Hood, and Fascia: Welded sheet metal assembly of the following sheet metal(s):
1. Galvanized Steel: Hot-dip galvanized steel sheet with **G90 (Z275)** zinc coating, complying with ASTM A 653/A 653M.

2.5 LOCKING DEVICES

- A. Locking Device Assembly: Fabricate with spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.

2.6 CURTAIN ACCESSORIES

- A. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.

2.7 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless or welded carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than **0.03 in./ft. (2.5 mm/m)** of span under full load.
- C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.8 MANUAL DOOR OPERATORS

- A. General: Equip door with manual door operator by door manufacturer.
- B. Push-up Door Operation: Design counterbalance mechanism so that required lift or pull for door operation does not exceed 25 lbf (111 N).

2.9 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.10 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install coiling counter doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Install coiling counter doors, hoods, controls, and operators at the mounting locations indicated for each door.

3.3 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.

3.4 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of coiling-door Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for door operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
1. Perform maintenance, including emergency callback service, during normal working hours.

END OF SECTION 083313

SECTION 083613 - SECTIONAL DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes electrically operated sectional doors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type and size of sectional door and accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
 - 1. Include plans, elevations, sections, and mounting details.
 - 2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
 - 4. Include diagrams for power, signal, and control wiring.
- C. Samples for Initial Selection: For units with factory-applied finishes.
 - 1. Include Samples of accessories involving color selection.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sectional doors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
- B. Regulatory Requirements: Comply with applicable provisions in ICC A117.1.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Failure of components or operators before reaching required number of operation cycles.
 - c. Faulty operation of hardware.
 - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
 - e. Delamination of exterior or interior facing materials.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

- A. Source Limitations: Obtain sectional doors from single source from single manufacturer.
 - 1. Obtain operators and controls from sectional door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Sectional doors shall comply with performance requirements specified without failure due to defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.
- B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
 - 1. Design Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft. (960 Pa), acting inward and outward.
 - 2. Testing: According to ASTM E 330.
 - 3. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components.
 - a. Deflection of door sections in horizontal position (open) shall not exceed 1/120 of the door width.
 - b. Deflection of horizontal track assembly shall not exceed 1/240 of the door height.

- C. Windborne-Debris Impact Resistance: Provide sectional doors that pass missile-impact and cyclic-pressure tests according to DASMA 102.
 - 1. Large Missile Test: For overhead coiling doors located within 30 feet (9.144 m) of grade.
- D. Seismic Performance: Sectional doors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. Component Importance Factor: 1.5.

2.3 DOOR ASSEMBLY

- A. Steel Sectional Door: Sectional door formed with hinged sections and fabricated according to DASMA 102 unless otherwise indicated.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Overhead Door Corporation Series 416 or comparable product by one of the following:
 - a. Clopay Building Products.
 - b. Haas Door.
 - c. Raynor.
 - d. Rite-Hite Corporation.
 - e. Wayne-Dalton Corp.
 - f. Windsor Door.
- B. Operation Cycles: Door components and operators capable of operating for not less than 25,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
- C. Air Infiltration: Maximum rate of 0.08 cfm/sq. ft. (0.406 L/s per sq. m) at 15 and 25 mph (24.1 and 40.2 km/h) when tested according to ASTM E 283.
- D. Steel Sections: Zinc-coated (galvanized) steel sheet with G60 (Z180) zinc coating.
 - 1. Section Thickness: 2 inches (51 mm).
 - 2. Exterior-Face, Steel Sheet Thickness: 0.064-inch- (1.63-mm-) nominal coated thickness.
 - a. Surface: Flat.
 - b. Surface: Manufacturer's standard, paneled.
- E. Track Configuration: Standard-lift track.
- F. Weatherseals: Fitted to bottom and top and around entire perimeter of door.
- G. Roller-Tire Material: Manufacturer's standard.
- H. Counterbalance Type: Torsion spring.
- I. Electric Door Operator:
 - 1. Usage Classification: Standard duty, up to 25 cycles per hour and up to 90 cycles per day.
 - 2. Operator Type: Trolley.

3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 feet (2.4 m) or lower.
4. Motor Exposure: Exterior, dusty, wet, or humid.
5. Emergency Manual Operation: Push-up type.
6. Obstruction-Detection Device: Automatic photoelectric sensor.
7. Control Station: Interior-side mounted.

2.4 MATERIALS, GENERAL

- 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.

2.5 STEEL DOOR SECTIONS

- A. Exterior Section Faces and Frames: Zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, complying with ASTM A 653/A 653M, with indicated zinc coating and thickness.
 1. Fabricate section faces from single sheets to provide sections not more than 24 inches (610 mm) high and of indicated thickness. Roll horizontal meeting edges to a continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove weather-resistant seal, with a reinforcing flange return.
- B. Section Ends and Intermediate Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet not less than 0.064-inch- (1.63-mm-) nominal coated thickness and welded to door section. Provide intermediate stiles formed from not less than 0.064-inch- (1.63-mm-) thick galvanized-steel sheet, cut to door section profile, and welded in place. Space stiles not more than 48 inches (1219 mm) apart.
- C. Reinforce bottom section with a continuous channel or angle conforming to bottom-section profile.
- D. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Provide galvanized-steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place.
- E. Provide reinforcement for hardware attachment.
- F. Fabricate sections so finished door assembly is rigid and aligned, with tight hairline joints and free of warp, twist, and deformation.

2.6 TRACKS, SUPPORTS, AND ACCESSORIES

- A. Tracks: Manufacturer's standard, galvanized-steel track system of configuration indicated, sized for door size and weight, designed for lift type indicated and clearances indicated on Drawings, Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides for required door type, size, weight, and loading.
 1. Galvanized Steel: ASTM A 653/A 653M, minimum G60 (Z180) zinc coating.
 2. Slope tracks at an angle from vertical or design tracks to ensure tight closure at jambs when door unit is closed.

3. Track Reinforcement and Supports: Galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced **2 inches (51 mm)** apart for door-drop safety device.
 - a. For Vertical Track: Continuous reinforcing angle attached to track and attached to wall with jamb brackets.
 - b. For Horizontal Track: Continuous reinforcing angle from curve in track to end of track, attached to track and supported at points by laterally braced attachments to overhead structural members.
- B. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and top of sectional door unless otherwise indicated.

2.7 HARDWARE

- A. General: Heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.
- B. Hinges: Heavy-duty, galvanized-steel hinges of not less than **0.079-inch- (2.01-mm-)** nominal coated thickness at each end stile and at each intermediate stile, according to manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is impossible. Provide double-end hinges where required, for doors more than **16 feet (4.88 m)** wide unless otherwise recommended by door manufacturer.
- C. Rollers: Heavy-duty rollers with steel ball-bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide **3-inch- (76-mm-)** diameter roller tires for **3-inch- (76-mm-)** wide track and **2-inch- (51-mm-)** diameter roller tires for **2-inch- (51-mm-)** wide track.
- D. Push/Pull Handles: Equip each push-up operated or emergency-operated door with galvanized-steel lifting handles on each side of door, finished to match door.

2.8 COUNTERBALANCE MECHANISM

- A. Torsion Spring: Counterbalance mechanism consisting of adjustable-tension torsion springs fabricated from steel-spring wire complying with ASTM A 229/A 229M, mounted on torsion shaft made of steel tube or solid steel. Provide springs designed for number of operation cycles indicated.
- B. Cable Drums and Shaft for Doors: Cast-aluminum or gray-iron casting cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft. Provide one additional midpoint bracket for shafts up to **16 feet (4.88 m)** long and two additional brackets at one-third points to support shafts more than **16 feet (4.88 m)** long unless closer spacing is recommended by door manufacturer.
- C. Cables: Galvanized-steel, multistrand, lifting cables with cable safety factor of at least 5 to 1.
- D. Cable Safety Device: Include a spring-loaded steel or spring-loaded bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if either lifting cable breaks.
- E. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.

- F. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.

2.9 ELECTRIC DOOR OPERATORS

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and "operation cycles" requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
1. Manufacturers: Subject to compliance with requirements, provide products by same manufacturer as overhead door including manufacturer recommended accessories as specified or indicated elsewhere in this Section.
 2. Comply with NFPA 70.
 3. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24-V ac or dc.
- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
- C. Door-Operator Type: Unit consisting of electric motor, gears, pulleys, belts, sprockets, chains, and controls needed to operate door and meet required usage classification.
1. Trolley: Trolley operator mounted to ceiling above and to rear of door in raised position and directly connected to door with drawbar.
- D. Motors: Reversible-type motor for motor exposure indicated.
1. Electrical Characteristics:
 - a. Phase: Single phase.
 - b. Volts: 115 V.
 - c. Hertz: 60.
 2. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. (203 mm/s) and not more than 12 in./sec. (305 mm/s), without exceeding nameplate ratings or service factor.
 3. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 4. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
 5. Use adjustable motor-mounting bases for belt-driven operators.
- E. Limit Switches: Equip motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- F. Obstruction Detection Device: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.
1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.

- a. Self-Monitoring Type: Designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door closes only with sustained pressure on close button.
- G. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure, push-button control labeled "Close."
 1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
- H. Emergency Manual Operation: Equip electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf (111 N).
- I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.10 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.11 STEEL AND GALVANIZED-STEEL FINISHES

- A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Tracks:
 - 1. Fasten vertical track assembly to opening jambs and framing, spaced not more than **24 inches (610 mm)** apart.
 - 2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.
- C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.
- D. Power-Operated Doors: Install automatic garage doors openers according to UL 325.

3.3 STARTUP SERVICES

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust doors and seals to provide weather-resistant fit around entire perimeter.
- D. Touch-up Painting: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A 780/A 780M.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION 083613

SECTION 085113 - ALUMINUM WINDOWS

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 aluminum windows for exterior locations.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for aluminum windows.
- B. Shop Drawings: Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
 - 1. Include similar Samples of hardware and accessories involving color selection.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranties: For manufacturer's warranties.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports, and calculations.
- B. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:

- a. Failure to meet performance requirements.
 - b. Structural failures including excessive deflection, water leakage, condensation, and air infiltration.
 - c. Faulty operation of movable sash and hardware.
 - d. Deterioration of materials and finishes beyond normal weathering.
 - e. Failure of insulating glass.
2. Warranty Period:
- a. Window: 10 years from date of Substantial Completion.
 - b. Glazing Units: 10 years from date of Substantial Completion.
 - c. Aluminum Finish: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. EFCO Corporation; a Pella company.
 2. Kawneer North America; an Alcoa company.
 3. YKK AP America Inc.
- B. Source Limitations: Obtain aluminum windows from single source from single manufacturer.

2.2 WINDOW PERFORMANCE REQUIREMENTS

- A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
1. Window Certification: AMMA certified with label attached to each window.
- B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
1. Minimum Performance Class: LC.
 2. Minimum Performance Grade: 50.

2.3 ALUMINUM WINDOWS

- A. Operating Types: Provide the following operating types in locations indicated on Drawings:
1. Double hung.
- B. Frames and Sashes: Aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.
1. Thermally Improved Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.

- C. Insulating-Glass Units: ASTM E 2190.
 - 1. Glass: ASTM C 1036, Type 1, Class 1, q3.
 - a. Tint: Clear.
 - 2. Lites: Two.
 - 3. Filling: Fill space between glass lites with air.
 - 4. Low-E Coating: Pyrolytic on second surface.
- D. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.
- E. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.
- F. Hung Window Hardware:
 - 1. Counterbalancing Mechanism: Complying with AAMA 902, concealed, of size and capacity to hold sash stationary at any open position.
 - 2. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.
 - 3. Tilt Latch: Releasing latch allows sash to pivot about horizontal axis to facilitate cleaning exterior surfaces from the interior.
- G. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.
- H. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
 - 1. Exposed Fasteners: Do not use exposed fasteners to the greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.4 FABRICATION

- A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.
- B. Glaze aluminum windows in the factory.
- C. Weather strip each operable sash to provide weathertight installation.
- D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.
- E. Provide water-shed members above side-hinged sashes and similar lines of natural water penetration.
- F. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design wind loads of window units.

- G. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.5 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. High-Performance Organic Finish (Two-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Organic Coating: manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2604 and with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: As selected by Architect from full range of industry colors and color densities.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.
- C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.

- B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.
- C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
- D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.
- B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
 - 1. Keep protective films and coverings in place until final cleaning.
- C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION 085113

SECTION 087100 - DOOR HARDWARE

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. Mechanical door hardware for the following:
 - a. Swinging doors.
 - 2. Cylinders for door hardware specified in other Sections.
- B. Related Sections:
 - 1. Section 081113 "Hollow Metal Doors and Frames".

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Samples for Initial Selection: For plastic protective trim units in each finish, color, and texture required for each type of trim unit indicated.
- C. Other Action Submittals:
 - 1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - a. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
 - b. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
 - c. Content: Include the following information:
 - 1) Identification number, location, hand, fire rating, size, and material of each door and frame.
 - 2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.

- 3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
- 4) Fastenings and other pertinent information.
- 5) Explanation of abbreviations, symbols, and codes contained in schedule.
- 6) Mounting locations for door hardware.
- 7) List of related door devices specified in other Sections for each door and frame.

2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Special warranty specified in this Section.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedules.

- B. Source Limitations: Obtain each type of door hardware from a single manufacturer.

- C. Means of Egress Doors: Latches do not require more than **15 lbf (67 N)** to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

- D. Accessibility Requirements: For door hardware on doors in an accessible route, comply with ICC/ANSI A117.1.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than **5 lbf (22.2 N)**.
2. Comply with the following maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: **5 lbf (22.2 N)** applied perpendicular to door.
 - b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than **1/2 inch (13 mm)** high.
4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point **3 inches (75 mm)** from the latch, measured to the leading edge of the door.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

1.8 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of doors and door hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 - 2. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.
 - a. Electromagnetic Locks: Five years from date of Substantial Completion.
 - b. Manual Closers: 10 years from date of Substantial Completion.

1.10 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or

replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Provide parts and supplies that are the same as those used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.
 - 1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products or products equivalent in function and comparable in quality to named products from list of approved manufacturers.
 - 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:
 - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.
 - 2. References to BHMA Designations: Provide products complying with these designations and requirements for description, quality, and function.

2.2 HINGES

- A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. Baldwin Hardware Corporation.
 - b. Hager Companies.
 - c. IVES Hardware; an Ingersoll-Rand company.
 - d. McKinney Products Company; an ASSA ABLOY Group company.
 - e. Stanley Commercial Hardware; Div. of The Stanley Works.

2.3 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: As indicated in door hardware schedule.
- B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
 - 1. Bored Locks: Minimum **1/2-inch (13-mm)** latchbolt throw.
- C. Lock Backset: **2-3/4 inches (70 mm)**, unless otherwise indicated.

- D. Lock Trim:
1. Description: As indicated by manufacturer's designations in schedule.
 2. Levers: Cast.
 3. Escutcheons (Roses): Cast.
 4. Dummy Trim: Match lever lock trim and escutcheons.
 5. Operating Device: Lever with escutcheons (roses).
- E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
 4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.
- F. Bored Locks: BHMA A156.2; Grade 1; Series 4000.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. Best Access Systems; Div. of Stanley Security Solutions, Inc.
 - b. Falcon Lock; An Ingersoll-Rand Company.
 - c. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
 - d. Schlage Commercial Lock Division; an Ingersoll-Rand company.
 - e. Yale Security Inc.; an ASSA ABLOY Group company.

2.4 LOCK CYLINDERS

- A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.
1. Manufacturer: Same manufacturer as for locking devices.
- B. Standard Lock Cylinders: BHMA A156.5; Grade 1; permanent cores that are removable; face finished to match lockset.

2.5 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.
1. Key System: Coordinate with Owner and match existing building keying system.
 2. Keyed Alike: Key all cylinders to same change key.
- B. Keys: Nickel silver.
1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
 - a. Notation: "DO NOT DUPLICATE."

2. Quantity: In addition to one extra key blank for each lock, provide the following:
 - a. Grand Master Keys: Five.

2.6 ACCESSORIES FOR PAIRS OF DOORS

- A. Astragals: BHMA A156.22.

2.7 SURFACE CLOSERS

- A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
 - b. DORMA Architectural Hardware; Member of The DORMA Group North America.
 - c. LCN Closers; an Ingersoll-Rand company.
 - d. Norton Door Controls; an ASSA ABLOY Group company.
 - e. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
 - f. Yale Security Inc.; an ASSA ABLOY Group company.
 - g. .

2.8 MECHANICAL STOPS AND HOLDERS

- A. Wall- and Floor-Mounted Stops: BHMA A156.16; polished cast brass, bronze, or aluminum base metal.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. Architectural Builders Hardware Mfg., Inc.
 - b. Burns Manufacturing Incorporated.
 - c. Hager Companies.
 - d. IVES Hardware; an Ingersoll-Rand company.
 - e. Rockwood Manufacturing Company.

2.9 OVERHEAD STOPS AND HOLDERS

- A. Overhead Stops and Holders: BHMA A156.8.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. Architectural Builders Hardware Mfg., Inc.
 - b. Glynn-Johnson; an Ingersoll-Rand company.
 - c. Rockwood Manufacturing Company.

2.10 DOOR GASKETING

- A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. National Guard Products.
 - b. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
 - c. Reese Enterprises, Inc.
 - d. Zero International.

2.11 AUXILIARY DOOR HARDWARE

- A. Auxiliary Hardware: BHMA A156.16.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. Baldwin Hardware Corporation.
 - b. Hager Companies.
 - c. Rockwood Manufacturing Company.

2.12 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.
1. Manufacturer's identification is permitted on rim of lock cylinders only.
- B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.
- C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
 2. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
 3. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.13 FINISHES

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
- B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of

door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

- D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches (750 mm) of door height greater than 90 inches (2286 mm).
- E. Lock Cylinders: Install construction cores to secure building and areas during construction period.
- F. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."
- G. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
- H. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- I. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- J. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DOOR HARDWARE SCHEDULE

The following items are basis-of-design hardware manufacturers for the references in the hardware sets listed below. The number of items listed are per door leaf.

Hinges:	Hagar
Lockset:	Schlage
Cylinder:	Medeco
Closer:	LCN
Door Operator:	LCN
Stops:	Ives
Seals:	National Guard Products (NGP)
Silencers:	Glynn Johnson
O.H. Stops:	Glynn Johnson
Flush Bolts:	Rockwood
Elec. Strikes:	Von Duprin
Power Supply:	Schlage
Kickplates:	Rockwood
Push/Pulls:	Rockwood
Threshold:	National Guard Products (NGP)

BUILDING 'B' DOOR HARDWARE

HARDWARE SET NO. 001

DOOR NUMBERS: 100A (Existing door and frame to be replaced)

3 ea	Hagar Butts BB1168 – 26D 4 ½ x 4 ½ - NRP
1 ea	Lockset ND92PDxRhodes-626
1	Cylinder 10*0500x6-PINx626 (Coordinate keying with Owner)
1	Automatic Door Operators LCN 9142 with full cover; interface with door security operation
1	Elec. Strike 6211ALxFSExDSx24xUS32D
1	Power Supply PS904
1	Kickplate K1050 10 x 2” L.D.W. x B4E – 32D
3	Silencers GJ64
1	Seals – NGP 152S, set for door head and jambs
1	Threshold – NGP 8425

HARDWARE SET NO. 002

DOOR NUMBERS: 100, 108, 108A and 109

3 ea	Hagar Butts BB1168 – 26D 4 ½ x 4 ½
1 ea	Lockset ND70PDxRhodes-626
1	Cylinder 10*0500x6-PINx626 (Coordinate keying with Owner)
1	Closer 1461 x Cush-N-Stop - Alum
1	Kickplate K1050 10 x 2” L.D.W. x B4E – 32D
3	Silencers GJ64D

HARDWARE SET NO. 003

DOOR NUMBERS: 105 and 107

- 3 ea Hagar Butts BB1168 – 26D 4 ½ x 4 ½
- 1 ea Lockset ND80PDxRhodes-626
- 1 Cylinder 10*0500x6-PINx626 (Coordinate keying with Owner)
- 1 LCN 1461x PA x HCUSH – ALUM (Push side)
- 1 Kickplate K1050 10 x 2” L.D.W. x B4E – 32D
- 3 Silencers GJ64
- 1 O.H. Holder GJ90H – 26D (Door EX2 only)
- 1 Stop 400 – 26D

HARDWARE SET NO. 004

DOOR NUMBERS: 102 and 103

- 3 ea Hagar Butts BB1168 – 26D 4 ½ x 4 ½
- 1 ea Lockset ND40SxRhodes-626
- 1 LCN 1461x PA x HCUSH – ALUM (Push side)
- 1 Kickplate K1050 10 x 2” L.D.W. x B4E – 32D
- 3 Silencers GJ64
- 1 Stop 400 – 26D

HARDWARE SET NO. 005

DOOR NUMBERS: EX2, EX3, EX4, EX7, and EX9

Existing Hardware To Remain on Existing Doors.

BUILDING ‘C’ and ‘D’ DOOR HARDWARE

HARDWARE SET NO. 001

DOOR NUMBERS: 102 and 104

- 3 ea Hagar Butts BB1168 – 26D 4 ½ x 4 ½ - NRP
- 1 ea Lockset ND50PDxRhodes-626
- 1 Cylinder 10*0500x6-PINx626 (Coordinate keying with Owner)
- 1 Closer 1461xPA – Alum
- 1 Kickplate K1050 10 x 2” L.D.W. x B4E – 32D
- 3 Silencers GJ64
- 1 Stop WS401CVX – US26D

HARDWARE SET NO. 002

DOOR NUMBERS: 112

- 6 ea Hagar Butts BB1168 – 26D 4 ½ x 4 ½
- 1 ea Lockset ND50PDxRhodes-626
- 1 Cylinder 10*0500x6-PINx626 (Coordinate keying with Owner)
- 2 Flush Bolts 555-26Dx570 DP Strike
- 1 O.H. Stop GJ90Sx626 (inactive leaf)
- 1 Closer 1461 x HCUSH – Alum (active leaf only)
- 1 Kickplate K1050 10 x 2” L.D.W. x B4E – 32D
- 3 Silencers GJ64D
- 1 Seals 152SA, set for door head and jambs

HARDWARE SET NO. 003

DOOR NUMBERS: 113, 115, and 201

- 3 ea Hagar Butts BB1168 – 26D 4 ½ x 4 ½
- 1 ea Lockset ND80PDxRhodes-626
- 1 Cylinder 10*0500x6-PINx626 (Coordinate keying with Owner)
- 1 LCN 1461x PA x HCUSH – ALUM (Push side)
- 1 Kickplate K1050 10 x 2” L.D.W. x B4E – 32D
- 3 Silencers GJ64
- 1 Stop WS401CVX – US26D

HARDWARE SET NO. 004

DOOR NUMBERS: 101

- 3 ea Butts BB1168 4 ½ x 4 ½ - 26D
- 1 ea Lockset ND60PDxRhodes-626
- 1 Cylinder 10*0500x6-PINx626 (Coordinate keying with Owner)
- 1 Closer 4041xPA – Alum
- 1 Seals 152SA, set for door head and jambs
- 1 Sweep 200SA

HARDWARE SET NO. 005

DOOR NUMBERS: 106

- 3 ea Hagar Butts BB1168 – 26D 4 ½ x 4 ½
- 1 ea Lockset ND73PDxRhodes-626
- 1 Cylinder 10*0500x6-PINx626 (Coordinate keying with Owner)
- 1 Kickplate K1050 10 x 2” L.D.W. x B4E – 32D
- 3 Silencers GJ64
- 1 Stop WS401CVX – US26D

HARDWARE SET NO. 006

DOOR NUMBERS: EX11 AND EX12

- 3 ea Hagar Butts BB1168 – 26D 4 ½ x 4 ½
- 1 ea Lockset ND73PDxRhodes-626
- 1 Cylinder 10*0500x6-PINx626 (Coordinate keying with Owner)
- 1 Closer 1461xPA – Alum
- 1 Kickplate K1050 10 x 2” L.D.W. x B4E – 32D
- 3 Silencers GJ64
- 1 Stop WS401CVX – US26D

HARDWARE SET NO. 007

DOOR NUMBERS: EX11 AND EX12

- 1 Automatic Door Operators LCN 9142 with full cover; interface with door security operation
Remaining Hardware To Remain

HARDWARE SET NO. 008

DOOR NUMBERS: EX2, EX4, EX4, EX7, EX8, EX9, EX10 and EX13

Existing Hardware To Remain.

END OF SECTION 087100

SECTION 087113 - 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Low-energy door operators for swinging doors.

1.3 DEFINITIONS

- A. AAADM: American Association of Automatic Door Manufacturers.
- B. Activation Device: A control that, when actuated, sends an electrical signal to the door operator to open the door.
- C. Double-Egress (Doors): A pair of doors that simultaneously swing with the two doors moving in opposite directions with no mullion between them.
- D. Double-Swing (Doors): A pair of doors that swing with the two doors moving in opposite directions with a mullion between them; each door functioning as a single-swing door.
- E. Safety Device: A control that, to avoid injury, prevents a door from opening or closing.
- F. For automatic door terminology, see BHMA A156.10 and BHMA A156.19 for definitions of terms.

1.4 COORDINATION

- A. Templates: Distribute for doors, frames, and other work specified to be factory prepared and reinforced for installing automatic door operators.
- B. Coordinate hardware for doors with operators to ensure proper size, thickness, hand, function, and finish.
- C. Electrical System Roughing-in: Coordinate layout and installation of automatic door operators with connections to power supplies and access-control system.

1.5 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 automatic door operators.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For automatic door operators.

1. Include plans, elevations, sections, hardware mounting heights, and attachment details.
2. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Indicate locations of activation and safety devices.
4. Include diagrams for power, signal, and control wiring.
5. Include plans, elevations, sections, and attachment details for guide rails.

1.6 INFORMATIONAL SUBMITTALS

- A. Sample Warranties: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For automatic door operators, safety devices, and control systems, to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for installation and maintenance of units required for this Project.

1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

- B. Certified Inspector Qualifications: Certified by AAADM.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of automatic door operators that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Faulty or sporadic operation of automatic door operator, including controls.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering or use.
2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Besam Entrance Solutions; Subsidiary of ASSA ABLOY Entrance Systems.
 2. DORMA Architectural Hardware; Div. of DORMA Group North America.
 3. LCN Closers; an Ingersoll-Rand company.
 4. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
 5. Stanley Access Technologies, LLC; Div. of Stanley Security Solutions.
- B. Source Limitations: Obtain automatic door operators, including activation and safety devices, from single source from single manufacturer.

2.2 AUTOMATIC DOOR OPERATORS, GENERAL

- A. General: Provide 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 occupancy type indicated; and according to UL 325. Coordinate operator mechanisms with door operation, hinges, and activation and safety devices.
1. Wind Load: Provide door operators on exterior doors that will open and close doors and maintain them in fully closed position when subjected to wind load of 20 pounds per square foot.
- B. Electromechanical Operating System: Self-contained unit powered by permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor, connections for power and activation- and safety-device wiring, and manual operation including spring closing when power is off.
- C. Cover for Surface-Mounted Operators: Fabricated from **0.125-inch- (3.2-mm-)** thick, extruded or formed aluminum ; continuous over full width of operator-controlled door opening; with enclosed end caps, provision for maintenance access, and fasteners concealed when door is in closed position.
- D. Brackets and Reinforcements: Fabricated from aluminum with nonstaining, nonferrous shims for aligning system components.
- E. 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.

2.3 LOW-ENERGY DOOR OPERATORS

- A. Standard: BHMA A156.19.
- B. Performance Requirements:

1. Opening Force if Power Fails: Not more than 15 lbf (67 N) required to release latch if provided, not more than 30 lbf (133 N) required to manually set door in motion, and not more than 15 lbf (67 N) required to fully open door.
 2. Entrapment-Prevention Force: Not more than 15 lbf (67 N) required to prevent stopped door from closing or opening.
- C. Configuration: Operator to control single swinging door.
1. Traffic Pattern: One way.
 2. Operator Mounting: Surface.
- D. Operation: Power opening and power-assisted spring closing. Provide time delay for door to remain open before initiating closing cycle as required by BHMA A156.19. When not in automatic mode, door operator shall function as manual door closer, with or without electrical power.
- E. Operating System: Electromechanical.
- F. Microprocessor Control Unit: Solid-state controller.
- G. Features:
1. Adjustable opening and closing speed.
 2. Adjustable opening and closing force.
 3. Adjustable backcheck.
 4. Adjustable hold-open time from zero to 30 seconds.
 5. Adjustable time delay.
 6. Adjustable acceleration.
 7. Obstruction recycle.
 8. On-off/hold-open switch to control electric power to operator.
- H. Activation Device: Push-plate switch on each side of door to activate door operator.
- I. Exposed Finish: Class I, clear anodic finish.

2.4 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
1. Extrusions: ASTM B 221 (ASTM B 221M).
 2. Sheet: ASTM B 209 (ASTM B 209M).
- B. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, stretcher-leveled standard of flatness, in manufacturer's standard thickness.
- C. Fasteners and Accessories: Corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.5 CONTROLS

- A. General: Provide controls, including activation and safety devices, according to BHMA standards; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for

occupancy type indicated. Coordinate activation and safety devices with door operation and door operator mechanisms.

- B. Push-Plate Switch: Momentary-contact door control switch with flat push-plate actuator with contrasting-colored, engraved message.
 - 1. Configuration: Rectangular push plate with 2-by-4-inch (50-by-100-mm) junction box.
 - a. Mounting: Recess mounted, semiflush in wall.
 - 2. Push-Plate Material: Stainless steel as selected by Architect from manufacturer's full range.
 - 3. Message: International symbol of accessibility and "Push to Open."
- C. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.

2.6 FABRICATION

- A. Factory fabricate automatic door operators to comply with indicated standards.
- B. Form aluminum shapes before finishing.
- C. Fabricate exterior components to drain condensation and water passing joints within operator enclosure to the exterior.
- D. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match operator.

2.7 ACCESSORIES

- A. Signage: As required by cited BHMA standard for type of door and its operation.
 - 1. Application Process: Operator manufacturer's standard process.
 - 2. Provide sign materials with instructions for field application when operators are installed.

2.8 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary protective covering before shipping.
- B. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

2.9 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, door and frame preparation and reinforcements, and other conditions affecting performance of automatic door operators.
- B. Examine roughing-in for electrical systems to verify actual locations of power connections before automatic door operator installation.
- C. Verify that full-height finger guards are installed at each door with pivot hinges where door has a clearance at hinge side greater than **1/4 inch (6 mm)** and less than **3/4 inch (19 mm)** with door in any position.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install automatic door operators according to manufacturer's written instructions and cited BHMA standard for type of door operation and direction of pedestrian travel, including signage, controls, wiring, remote power units if any, and connection to building's power supply.
 - 1. Do not install damaged components. Fit joints to produce hairline joints free of burrs and distortion.
 - 2. Install operators true in alignment with established lines and door geometry without warp or rack. Anchor securely in place.
- B. Controls: Install activation and safety devices according to manufacturer's written instructions and cited BHMA standard for operator type and direction of pedestrian travel. Connect control wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Signage: Apply on both sides of each door as required by cited BHMA standard for type of door operator and direction of pedestrian travel.

3.3 ADJUSTING

- A. Adjust automatic door operators to function smoothly, and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.
 - 1. Adjust operators on exterior doors for weathertight closure.
- B. After completing installation of automatic door operators, inspect exposed finishes on doors and operators. Repair damaged finish to match original finish.
- C. Readjust automatic door operators and controls after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).

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

3.4 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of automatic door operator Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 - 1. Engage a Certified Inspector to perform safety inspection after each adjustment or repair and at end of maintenance period. Furnish completed inspection reports to Owner.
 - 2. Perform maintenance, including emergency callback service, during normal working hours.
 - 3. Include 24-hour-per-day, 7-day-per-week, emergency callback service.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain automatic door operators.

END OF SECTION 087113

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

- 1. Doors.

1.3 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. Interspace: Space between lites of an insulating-glass unit.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.5 ACTION SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For glass and glazing products, from manufacturer.
- B. Preconstruction adhesion and compatibility test report.

- C. Warranties: Sample of special warranties.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- B. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
- C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.
- D. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F (4.4 deg C).

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

- A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
 - 1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
- B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

- C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.

2.2 GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
- B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
 2. For uncoated glass, comply with requirements for Condition A.

2.3 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
1. AAMA 804.3 tape, where indicated.
 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

2.4 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
- G. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.5 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep systems.
 - 3. Minimum required face and edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than **50 inches (1270 mm)**.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide **1/8-inch (3-mm)** minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. 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 substances immediately as recommended in writing 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 than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 088000

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

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. Non-load-bearing steel framing systems for interior gypsum board assemblies.

- B. Related Requirements:

- 1. Section 054000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

- 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
- 2. Protective Coating: ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized unless otherwise indicated.

- B. Studs and Runners: ASTM C 645.

- 1. Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: 0.027 inch (0.68 mm).
 - b. Depth: As indicated on Drawings.

- C. Slip-Type Head Joints: Where indicated, provide the following:

- 1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- (51-mm-) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.

- D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 - 1. Minimum Base-Metal Thickness: 0.027 inch (0.68 mm).
- E. Cold-Rolled Channel Bridging: Steel, 0.053-inch (1.34-mm) minimum base-metal thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
 - 1. Depth: 1-1/2 inches (38 mm).
 - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), 0.068-inch- (1.72-mm-) thick, galvanized steel.

2.2 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 - 1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

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 of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work 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.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.

- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Single-Layer Application: **16 inches (406 mm)** o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: 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.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. 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 in finished assembly.
 - 3. Other Framed Openings: 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.
- E. Direct Furring:
 - 1. Screw to wood framing.
 - 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced **24 inches (610 mm)** o.c.
- F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than **1/8 inch (3 mm)** from the plane formed by faces of adjacent framing.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Interior gypsum board.

- B. Related Requirements:

- 1. Section 092216 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.

1.3 ACTION SUBMITTALS

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

1.4 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. CertainTeed Corp.
2. Georgia-Pacific Gypsum LLC.
3. National Gypsum Company.
4. USG Corporation.

- B. Gypsum Wallboard: ASTM C 1396/C 1396M.

1. Thickness: **5/8 inch (15.8 mm)**.
2. Long Edges: Tapered.

- C. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: **5/8 inch (15.9 mm)**, Type X.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.3 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. Expansion (control) joint.

2.4 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.

- B. Joint Tape:

1. Interior Gypsum Board: Paper.

- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.

2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use 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 drying-type, all-purpose compound.

2.5 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than **1/16 inch (1.5 mm)** of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Wallboard Type: Vertical surfaces unless otherwise indicated.
2. Moisture- and Mold-Resistant Type: All toilet rooms.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 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. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners unless otherwise indicated.
2. LC-Bead: Use at exposed panel edges.

3.5 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

3.6 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following exterior substrates:
 - 1. Steel.
 - 2. Galvanized metal.
 - 3. Wood.
- B. Related Requirements:
 - 1. Section 099123 "Interior Painting" for surface preparation and the application of paint systems on interior substrates.

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- E. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Products: Paints are based on products by Sherwin-Williams Co. (Sherwin-Williams), as listed on the drawings. Subject to compliance with requirements, provide the named products or a comparable products by one of the following:
 - 1. Benjamin Moore & Co.
 - 2. ICI Paints.
 - 3. M.A.B. Paints.
 - 4. PPG Architectural Finishes, Inc.

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
 - 1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
- C. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- D. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.

- E. Colors: As indicated in a color schedule.

2.3 EXTERIOR PRIMERS

- A. Exterior Concrete and Masonry Primer: Factory-formulated alkali-resistant acrylic-latex primer for exterior application.
1. Benjamin Moore; Moore's Acrylic Masonry Sealer No. 066: Applied at a dry film thickness of not less than 0.7 mils.
 2. ICI Dulux Paints; 2000-1200 Dulux Professional Exterior 100 Percent Acrylic Latex Primer: Applied at a dry film thickness of not less than 1.6 mils.
 3. Sherwin-Williams; Loxon Exterior Masonry Acrylic Primer A24W300: Applied at a dry film thickness of not less than 3.0 mils.
- B. Exterior Ferrous-Metal Primer: Factory-formulated rust-inhibitive metal primer for exterior application.
1. Benjamin Moore; Moore's IMC Alkyd Metal Primer No. M06: Applied at a dry film thickness of not less than 2.0 mils.
 2. ICI Dulux Paints; 4160-XXXX Devguard Multi-Purpose Tank & Structural Primer. Applied at a dry film thickness of not less than 2.0 mils.
 3. Sherwin Williams Pro-Cryl Acrylic Primer B66-310 series. Applied at a dry film thickness of not less than 3 mils.
- C. Exterior Galvanized Metal Primer: Factory-formulated galvanized metal primer for exterior application.
1. Benjamin Moore; Moore's IMC Acrylic Metal Primer No. M04: Applied at a dry film thickness of not less than 2.0 mils.
 2. ICI Dulux Paints; 4020-XXXX Devflex DTM Flat Interior/Exterior Waterborne Primer & Finish: Applied at a dry film thickness of not less than 2.2 mils.
 3. Sherwin-Williams; primer not required over this substrate, except as indicated below.

2.4 EXTERIOR FINISH COATS

- A. Exterior Flat Acrylic Paint: Factory-formulated flat acrylic-emulsion latex paint for exterior application.
1. Benjamin Moore; Moorcraft Super Spec Flat Latex House Paint No. 171: Applied at a dry film thickness of not less than 1.2 mils.
 2. ICI Dulux Paints; 2200-XXXX Dulux Professional Exterior 100 Percent Acrylic Flat Finish: Applied at a dry film thickness of not less than 1.4 mils.
 3. Sherwin-Williams; A-100 Exterior Latex Flat House & Trim Paint A6 Series: Applied at a dry film thickness of not less than 1.3 mils.
- B. Exterior Semigloss Acrylic Enamel: Factory-formulated semigloss waterborne acrylic-latex enamel for exterior application.
1. Benjamin Moore; Moorcraft Super Spec Latex House & Trim Paint No. 170: Applied at a dry film thickness of not less than 1.1 mils.
 2. ICI Dulux Paints; 2406-XXXX Dulux Professional Exterior 100 Percent Acrylic Semi-Gloss Finish: Applied at a dry film thickness of not less than 1.3 mils.
 3. Sherwin-Williams; A-100 Latex Gloss A8 Series: Applied at a dry film thickness of not less than 1.3 mils.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Wood: 15 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- G. Wood Substrates:
 - 1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.

4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
 1. Use applicators and techniques suited for paint and substrate indicated.
 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 4. Paint entire exposed surface of window frames and sashes.
 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 1. Paint the following work where exposed to view:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Pipe hangers and supports.
 - d. Metal conduit.
 - e. Tanks that do not have factory-applied final finishes.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 EXTERIOR PAINT SCHEDULE

- A. Concrete and Masonry (Other Than Concrete Unit Masonry): Provide the following finish systems over exterior concrete, stucco, and brick masonry substrates, where indicated to receive paint:
 - 1. Semigloss Acrylic-Enamel Finish: over a primer.
 - a. Primer: Exterior concrete and masonry primer.
 - b. Finish Coats: Exterior semigloss acrylic enamel.
- B. Concrete Unit Masonry: Provide the following finish systems over exterior concrete unit masonry:
 - 1. Semigloss Acrylic-Enamel Finish: over a block filler.
 - a. Block Filler: Concrete unit masonry block filler.
 - b. Finish Coats: Exterior semigloss acrylic enamel.
- C. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.
 - 1. Semigloss Acrylic-Enamel Finish: over a rust-inhibitive primer.
 - a. Primer: Exterior ferrous-metal primer.
 - b. Finish Coats: Exterior semigloss acrylic enamel.
- D. Zinc-Coated Metal: Provide the following finish systems over exterior zinc-coated metal surfaces:
 - 1. Semigloss Acrylic-Enamel Finish: over a galvanized metal primer.
 - a. Primer: Exterior galvanized metal primer.
 - b. Finish Coats: Exterior semigloss acrylic enamel.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on interior substrates.
- B. Related Requirements:
 - 1. Section 099113 "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

3. VOC content.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than **45 deg F (7 deg C)**.
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between **50 and 95 deg F (10 and 35 deg C)**.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than **5 deg F (3 deg C)** above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Products: Paints are based on products by Sherwin-Williams Co. (Sherwin-Williams), as listed on the drawings. Subject to compliance with requirements, provide the named products or a comparable products by one of the following:
 1. Benjamin Moore & Co.
 2. ICI Paints.
 3. M.A.B. Paints.
 4. PPG Architectural Finishes, Inc.
- B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in other Part 2 articles for the paint category indicated.

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
 1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
- C. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

D. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Dry-Fog Coatings: 400 g/L.
4. Primers, Sealers, and Undercoaters: 200 g/L.
5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Floor Coatings: 100 g/L.
9. Shellacs, Clear: 730 g/L.
10. Shellacs, Pigmented: 550 g/L.

E. Colors: As indicated in a color schedule.

2.3 INTERIOR PRIMERS/SEALERS

A. Interior Concrete and Masonry Primer: Factory-formulated alkali-resistant acrylic-latex interior primer for interior application.

1. Benjamin Moore; Eco Spec® Interior Latex Primer Sealer No. 231: Applied at a dry film thickness of not less than 0.8 mils.
2. ICI Dulux Paints; LIFEMASTER 2000 Interior Primer-Sealer LM9116: Applied at a dry film thickness of not less than 1.8 mils.
3. Sherwin Williams Harmony Latex Primer B11W900. Applied at a dry film thickness of not less than 1.3 mils.

B. Interior Concrete and Masonry Primer for Water Based Epoxy Finishes: Factory-formulated alkali-resistant acrylic-latex or waterborne epoxy interior primer for interior application.

1. Benjamin Moore; Epoxy Block Filler No. M31/M32: Applied at a dry film thickness of not less than 10.0 mils.
2. ICI Devco Paints; TRU-GLAZE-WB 4010 Waterproofing Base Coat & Filler: Applied at a dry film thickness of not less than 10.0 mils.
3. Sherwin-Williams; Heavy Duty Block Filler B42W46: Applied at a dry film thickness of not less than 10.0 mils.

C. Interior Gypsum Board Primer: Factory-formulated latex-based primer for interior application.

1. Benjamin Moore; Eco Spec® Interior Latex Primer Sealer No. 231: Applied at a dry film thickness of not less than 0.8 mils.
2. ICI Dulux Paints; LIFEMASTER 2000 Interior Primer-Sealer LM9116: Applied at a dry film thickness of not less than 1.8 mils.
3. Sherwin Williams Harmony Interior Latex Primer B11W900. Applied at a dry film thickness of not less than 1.3 mils.

D. Interior Gypsum Board Primer for Water Based Epoxy Finishes: Factory-formulated latex-based or waterborne epoxy primer for interior application.

1. Benjamin Moore; Waterborne Epoxy Primer No. M08/M09: Applied at a dry film thickness of not less than 1.5 – 2.5 mils.
 2. ICI Dulux Paints; Ultra-Hide Aquacrylic GRIPPER Stain Killer Primer-Sealer No. 3210: Applied at a dry film thickness of not less than 1.5 mils, unless otherwise recommended by Manufacturer.
 3. Sherwin Williams Harmony Interior Latex Primer B11W900. Applied at a dry film thickness of not less than 1.3 mils.
- E. Interior Wood Primer for Semi-gloss Acrylic-Enamel Finishes: Factory-formulated acrylic-latex-based interior wood primer.
1. Benjamin Moore; Eco Spec® Interior Latex Primer Sealer No. 231: Applied at a dry film thickness of not less than 0.8 mils.
 2. ICI Dulux Paints; LIFEMASTER 2000 Interior Primer-Sealer LM9116: Applied at a dry film thickness of not less than 1.8 mils.
 3. Sherwin Williams Harmony Interior Latex Primer B11W900. Applied at a dry film thickness of not less than 1.3 mils.
- F. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.
- G. Interior Ferrous-Metal Primer: See Division 5 and 8 Sections for shop priming of metal substrates.
- H. Interior Zinc-Coated Metal Primer: See Division 5 and 8 Sections for shop priming of metal substrates.

2.4 INTERIOR FINISH COATS

- A. Interior Flat Acrylic Paint: Factory-formulated flat acrylic-emulsion latex paint for interior application.
1. Benjamin Moore; Eco Spec® Interior Latex Flat No. 219: Applied at a dry film thickness of not less than 1.2 mils.
 2. ICI Dulux Paints; LIFEMASTER 2000 Interior Flat No. LM9100: Applied at a dry film thickness of not less than 1.4 mils.
 3. Sherwin Williams Harmony Latex Flat B5 series: Applied at a dry film thickness of not less than 1.5 mils.
- B. Interior Flat Latex-Emulsion Size: Factory-formulated flat latex-based interior paint.
1. Benjamin Moore; Eco Spec® Interior Latex Flat No. 219: Applied at a dry film thickness of not less than 1.2 mils.
 2. ICI Dulux Paints; LIFEMASTER Interior Flat No. 9100: Applied at a dry film thickness of not less than 1.4 mils.
 3. Sherwin Williams Harmony Latex Flat B5 series: Applied at a dry film thickness of not less than @ 1.5 mils dft/ct.
- C. Interior Flat or Eggshell Waterborne Acrylic Dryfall Paint: Factory-formulated flat or eggshell latex-based interior paint.
1. Benjamin Moore; Sweep-Up Spray Latex Flat No. M53: Applied at a dry film thickness of not less than 1.5 mils.
 2. ICI Dulux Paints; 1280-XXXX Dulux Spraymaster Pro Uni-Grip-WB Aquacrylic Dryfall Paint: Applied at a dry film thickness of not less than 1.5 mils.
 3. Sherwin-Williams; Waterborne Acrylic Dryfall Eg-Shel Paint B42 Series: Applied at a dry film thickness of not less than 3.0 mils.

- D. Interior Low-Luster Acrylic Enamel: Factory-formulated eggshell acrylic-latex interior enamel.
1. Benjamin Moore; Eco Spec® Interior Latex Eggshell Enamel No. 223: Applied at a dry film thickness of not less than 1.4 mils.
 2. ICI Dulux Paints; LIFEMASTER Interior Eggshell No. 9300: Applied at a dry film thickness of not less than 1.4 mils.
 3. Sherwin Williams Harmony Latex Eg-Shel B9 series: Applied at a dry film thickness of not less than @ 1.5 mils dft/ct.
- E. Interior Semigloss Acrylic Enamel: Factory-formulated semigloss acrylic-latex enamel for interior application.
1. Benjamin Moore; Eco Spec® Interior Latex Semi-Gloss Enamel No. 224: Applied at a dry film thickness of not less than 1.4 mils.
 2. ICI Dulux Paints; LIFEMASTER Interior Semi-Gloss No. 9200: Applied at a dry film thickness of not less than 1.4 mils.
 3. Sherwin-Williams; ProClasic® Waterborn Acrylic Semi-Gloss Enamel B31 Series: Applied at a dry film thickness of not less than 1.4 mils.
- F. Interior Semi-Gloss Water Based Epoxy: Waterborne two-component epoxy, for interior (or exterior) use.
1. Benjamin Moore; Moorcraft Super Spec Acrylic Epoxy Coating No. 256: Applied at a dry film thickness of not less than 1.0-2.0 mils per coat.
 2. Sherwin-Williams; Water Based Catalyzed Semi-Gloss Epoxy B70-200 Series: Applied at a dry film thickness of not less than 2.5-3.0 mils per coat.

2.5 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 2. Testing agency will perform tests for compliance with product requirements.
 3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Concrete: 12 percent.

2. Masonry (Clay and CMU): 12 percent.
3. Wood: 15 percent.
4. Gypsum Board: 12 percent.
5. Plaster: 12 percent.

- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.
- E. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.
- F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 1. Use applicators and techniques suited for paint and substrate indicated.
 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Paint the following work where exposed in equipment rooms:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Pipe hangers and supports.
 - d. Metal conduit.
 2. Paint the following work where exposed in occupied spaces:
 - a. Uninsulated metal piping.
 - b. Pipe hangers and supports.
 - c. Metal conduit.
 3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
1. Contractor shall touch up and restore painted surfaces damaged by testing.
 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINT SCHEDULE

- A. Concrete and Masonry (Other Than Concrete Unit Masonry): Provide the following paint systems over interior concrete and brick masonry substrates:
 - 1. Low-Luster Acrylic-Enamel Finish: over a primer.
 - a. Primer: Interior concrete and masonry primer.
 - b. Finish Coats: Interior low-luster acrylic enamel.
 - 2. Interior Semi-Gloss Water Based Epoxy (Where Indicated): over a primer..
 - a. Primer: Interior concrete and masonry primer.
 - b. Finish Coats: Interior Semi-Gloss Water Based Epoxy.
- B. Concrete Unit Masonry: Provide the following finish systems over interior concrete masonry:
 - 1. Low-Luster Acrylic-Enamel Finish: over block filler.
 - a. Block Filler: Concrete unit masonry block filler.
 - b. Finish Coats: Interior low-luster acrylic enamel.
 - 2. Interior Semi-Gloss Water Based Epoxy (Where Indicated): over a filled surface.
 - a. Block Filler: Concrete unit masonry block filler.
 - b. Finish Coats: Interior Semi-Gloss Water Based Epoxy.
- C. Gypsum Board and Plaster: Provide the following finish systems over interior gypsum board surfaces:
 - 1. Flat Acrylic Finish (Ceilings): over a primer.
 - a. Primer: Interior gypsum board or plaster primer.
 - b. Finish Coats: Interior flat acrylic paint.
 - 2. Low-Luster Acrylic-Enamel Finish: over a primer.
 - a. Primer: Interior gypsum board or plaster primer.
 - b. Finish Coats: Interior low-luster acrylic enamel.
 - 3. Interior Semi-Gloss Water Based Epoxy (Where Indicated): over a primer.
 - a. Primer: Interior gypsum board or plaster primer.
 - b. Finish Coats: Interior Semi-Gloss Water Based Epoxy.
- D. Wood and Hardboard: Provide the following paint finish systems over new interior wood surfaces:
 - 1. Semigloss Acrylic-Enamel Finish: over a wood undercoater.

- a. Primer: Interior wood primer for acrylic-enamel and semigloss alkyd-enamel finishes.
 - b. Finish Coats: Interior semigloss acrylic enamel.
- E. Ferrous Metal: Provide the following finish systems over ferrous metal:
- 1. Semigloss Acrylic-Enamel Finish: over a primer.
 - a. Primer: Interior ferrous-metal primer.
 - b. Finish Coats: Interior semigloss acrylic enamel.
 - 2. Interior Semi-Gloss Water Based Epoxy (Where Indicated): over a primer.
 - a. Primer: Interior ferrous-metal primer.
 - b. Finish Coats: Interior Semi-Gloss Water Based Epoxy.
- F. Zinc-Coated Metal: Provide the following finish systems over interior zinc-coated metal surfaces:
- 1. Semigloss Acrylic-Enamel Finish: over a primer.
 - a. Primer: Interior zinc-coated metal primer.
 - b. Finish Coats: Interior semigloss acrylic enamel.
 - 2. Interior Semi-Gloss Water Based Epoxy (Where Indicated): over a primer.
 - a. Primer: Interior galvanized metal primer.
 - b. Finish Coats: Interior Semi-Gloss Water Based Epoxy.
- G. All-Service Jacket over Insulation: Provide the following finish system on cotton or canvas insulation covering:
- 1. Flat Acrylic Finish: Two finish coats. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coats: Interior flat latex-emulsion size.

END OF SECTION 099123

SECTION 102113 - TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Steel toilet compartments configured as toilet enclosures and urinal screens.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Show locations of cutouts for compartment-mounted toilet accessories.
 - 2. Show locations of reinforcements for compartment-mounted grab bars.
 - 3. Show locations of centerlines of toilet fixtures.
- C. Samples for Initial Selection: For each type of unit indicated. Include Samples of hardware and accessories involving material and color selection.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of toilet compartment, from manufacturer.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Comply with requirements in GSA's CID-A-A-60003, "Partitions, Toilets, Complete."
- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

C. Regulatory Requirements: Comply with applicable provisions in ICC/ANSI A117.1 for toilet compartments designated as accessible.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Castings: ASTM B 26/B 26M.
- B. Aluminum Extrusions: ~~ASTM B 221~~ (ASTM B 221M).
- C. Brass Castings: ASTM B 584.
- D. Brass Extrusions: ASTM B 455.
- E. Steel Sheet: Commercial steel sheet for exposed applications; mill phosphatized and selected for smoothness.
 1. Electrolytically Zinc Coated: ASTM A 879/A 879M, ~~01Z~~ (03G).
 2. Hot-Dip Galvanized: ASTM A 653/A 653M, either hot-dip galvanized or galvanized.
- F. Zamac: ASTM B 86, commercial zinc-alloy die castings.
- G. Particleboard: ANSI A208.1, Grade M-2 with ~~45-lb~~ (20.4-kg) density, made with binder containing no urea formaldehyde.
- H. Plastic Laminate: NEMA LD 3, general-purpose HGS grade, ~~0.048-inch~~ (1.2-mm) nominal thickness.
- I. Adhesives: Manufacturer's standard product that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 STEEL UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Accurate Partitions Corporation.
 2. All American Metal Corp.
 3. American Sanitary Partition Corporation.
 4. Ampco, Inc.
 5. Bradley Corporation; Mills Partitions.

6. Flush Metal Partition Corp.
 7. General Partitions Mfg. Corp.
 8. Global Steel Products Corp.
 9. Hadrian Manufacturing Inc.
 10. Knickerbocker Partition Corporation.
 11. Metpar Corp.
 12. Rockville Partitions Incorporated.
 13. Sanymetal; a Crane Plumbing company.
- B. Toilet-Enclosure Style: Overhead braced.
- C. Urinal-Screen Style: Wall hung, flat panel.
- D. Door, Panel, and Pilaster Construction: Seamless, metal facing sheets pressure laminated to core material; with continuous, interlocking molding strip or lapped-and-formed edge closures; corners secured by welding or clips and exposed welds ground smooth. Exposed surfaces shall be free of pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections.
1. Core Material: Manufacturer's standard sound-deadening honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of **1 inch (25 mm)** for doors and panels and **1-1/4 inches (32 mm)** for pilasters.
 2. Grab-Bar Reinforcement: Provide concealed internal reinforcement for grab bars mounted on units.
 3. Tapping Reinforcement: Provide concealed reinforcement for tapping (threading) at locations where machine screws are used for attaching items to units.
- E. Urinal-Screen Construction:
1. Flat-Panel Urinal Screen: Matching panel construction.
- F. Facing Sheets and Closures: Electrolytically coated steel sheet with nominal base-metal (uncoated) thicknesses as follows:
1. Pilasters, Braced at Both Ends: Manufacturer's standard thickness, but not less than **0.036 inch (0.91 mm)**.
 2. Panels: Manufacturer's standard thickness, but not less than **0.030 inch (0.76 mm)**.
 3. Doors: Manufacturer's standard thickness, but not less than **0.030 inch (0.76 mm)**.
 4. Flat-Panel Urinal Screens: Thickness matching the panels.
- G. Pilaster Shoes and Sleeves (Caps): Stainless-steel sheet, not less than **0.031-inch (0.79-mm)** nominal thickness and **3 inches (76 mm)** high, finished to match hardware.
- H. Brackets (Fittings):
1. Stirrup Type: Ear or U-brackets; chrome-plated zamac.
- I. Steel-Sheet Finish: Immediately after cleaning and pretreating, apply manufacturer's standard baked-on finish, including thermosetting, electrostatically applied, and powder coatings. Comply with coating manufacturer's written instructions for applying and baking. Apply one color in each room.
1. Color: As selected by Architect from manufacturer's full range.

2.3 ACCESSORIES

- A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.
1. Material: Chrome-plated zamac.
 2. Hinges: Manufacturer's standard paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees.
 3. Latch and Keeper: Manufacturer's standard recessed latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
 4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
 5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
 6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.
- B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.
- C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.

2.4 FABRICATION

- A. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
- B. Door Size and Swings: Unless otherwise indicated, provide **24-inch- (610-mm-)** wide, in-swinging doors for standard toilet compartments and **36-inch- (914-mm-)** wide, out-swinging doors with a minimum **32-inch- (813-mm-)** wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
1. Maximum Clearances:
 - a. Pilasters and Panels: **1/2 inch (13 mm)**.
 - b. Panels and Walls: **1 inch (25 mm)**.
 2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel.

- a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
- B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches (44 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.
- C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.2 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Fire-protection cabinets for the following:
 - a. Portable fire extinguishers.
- B. Related Requirements:
 - 1. Section 104416 "Fire Extinguishers."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.
 - 1. Show location of knockouts for hose valves.
- B. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.5 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

1.6 SEQUENCING

- A. Apply decals on field-painted fire-protection cabinets after painting is complete.

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.

2.2 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.

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

- a. Fire-End & Croker Corporation.
- b. GMR International Equipment Corporation.
- c. Guardian Fire Equipment, Inc.
- d. JL Industries, Inc.; a division of the Activar Construction Products Group.
- e. Larsens Manufacturing Company.
- f. Modern Metal Products, Division of Technico Inc.
- g. Nystrom, Inc.
- h. Potter Roemer LLC.
- i. Strike First Corporation of America.

- B. Cabinet Construction: Nonrated.

- C. Cabinet Material: Cold-rolled steel sheet.

1. Shelf: Same metal and finish as cabinet.

- D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

1. Rolled-Edge Trim: 2-1/2-inch (64-mm) backbend depth.

- E. Cabinet Trim Material: Steel sheet.

- F. Door Material: Steel sheet.

- G. Door Style: Center glass panel with frame.

- H. Door Glazing: Tempered float glass (clear).

- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide projecting door pull and friction latch.
2. Provide manufacturer's standard hinge permitting door to open 180 degrees.

- J. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.

2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.
 - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet door.
 - 2) Application Process: Decals or Pressure-sensitive vinyl letters.
 - 3) Lettering Color: Red.
 - 4) Orientation: Vertical.

K. Materials:

1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
 - a. Finish: Factory primed for field painting.
2. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.3 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 1. Weld joints and grind smooth.
 2. Provide factory-drilled mounting holes.
 3. Prepare doors and frames to receive locks.
 4. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum **1/2 inch (13 mm)** thick.
 2. Fabricate door frames of one-piece construction with edges flanged.
 3. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights indicated below:
 - 1. Fire-Protection Cabinets: **54 inches (1372 mm)** above finished floor to top of cabinet.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
 - 2. Provide inside latch and lock for break-glass panels.
 - 3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Identification: Apply decals or vinyl lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

SECTION 104416 - FIRE EXTINGUISHERS

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 portable, hand-carried fire extinguishers.
- B. Related Requirements:
 - 1. Section 104413 "Fire Protection Cabinets."

1.3 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.5 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amerex Corporation.
 - b. Ansul Incorporated.
 - c. Badger Fire Protection.
 - d. Buckeye Fire Equipment Company.
 - e. Fire End & Croker Corporation.
 - f. Guardian Fire Equipment, Inc.
 - g. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - h. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
 - i. Larsens Manufacturing Company.
 - j. Moon American.
 - k. Nystrom Building Products.
 - l. Pem All Fire Extinguisher Corp.
 - m. Potter Roemer LLC.
 - n. Pyro-Chem; Tyco Safety Products.
 - o. Strike First Corporation of America.
 - 2. Handles and Levers: Manufacturer's standard.
 - 3. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
- B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:60-B:C, **10-lb (4.5-kg)** nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 107313 - AWNINGS

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. Fixed awnings.

- B. Related Requirements:

- 1. Section 055000 "Metal Fabrications" for blocking, shims, reinforcing, and supplemental support members for connecting to awning frame and anchorage.
- 2. Section 061000 "Rough Carpentry" for blocking, nailers, shims, reinforcing, framing, and furring for connecting to awning frame and anchorage.

1.3 ACTION SUBMITTALS

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

- 1. Include styles, material descriptions, construction details, fabrication details, dimensions of individual components and profiles, hardware, fittings, mounting accessories, features, and finishes for awnings.
- 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

- B. Shop Drawings:

- 1. Include plans, elevations, sections, mounting heights, and attachment details.
- 2. Detail fabrication and assembly of awnings, including seam layout, spacing, and orientation of awning fabric.
- 3. Show locations for blocking, reinforcement, and supplementary structural support.
- 4. Graphics: Show text message, font, character sizes, and other graphic forms, character spacing, word spacing, line spacing, margin widths, position of copy, and other information related to graphic design.

- C. Samples for Initial Selection: For each type of exposed finish.

- 1. Include Samples of graphics on fabric and accessories involving color or finish selection.

- D. Delegated-Design Submittal: For awnings.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For awnings to include in operation and maintenance manuals.
1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Methods for maintaining awning fabrics and finishes.
 - b. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.
 - c. Operating hardware.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
1. Fabricator is a Master Fabric Craftsman certified by the Industrial Fabrics Association International.
 2. Fabricator's responsibilities include fabricating and installing awnings and providing professional engineering services needed to assume engineering responsibility.
- B. Installer Qualifications: Fabricator of products.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.7 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit installation of awnings in exterior locations to be performed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements: Where awning installation is indicated to fit to other work, verify dimensions of other work by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for fenestration operation throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.8 WARRANTY

- A. Special Warranty: Manufacturer and fabricator agree to repair or replace components of awnings that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Structural failures including framework.
 - b. Deterioration of fabric including seam failure.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
2. Awning Warranty Period: Five years from date of Substantial Completion.
3. Fabric Warranty Period: Five years from date of Substantial Completion.
4. Thread Warranty Period: Five years from date of Substantial Completion.
5. Graphics Warranty Period: Outdoor durability not less than five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer to design awnings.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- C. Regulatory Requirements: Provide awnings complying with Insert loading and other requirements and limitations of authorities having jurisdiction that are within Contractor's control.

2.2 AWNING FABRICS

- A. Fire-Test-Response Characteristics: Provide awning fabrics with the fire-test-response characteristics indicated, as determined by testing identical products according to test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 1. Flame-Resistance Ratings: Passes NFPA 701.
 2. Permanently attach label to each awning fabric indicating whether fabric is inherently and permanently flame resistant or is treated with flame-retardant chemicals, and whether it requires retreatment after designated time period or cleaning.
- B. Design: Traditional.
- C. Fabric Fiber Content: Vinyl-laminated or -coated polyester mesh.
 1. Fabric Weight: 17 ounces per lineal yard.
 2. Width: 62 inches.
 3. Color: As selected by Architect from manufacturer's full range.
 4. Performance Characteristics: As follows:
 - a. Mildew Resistance: Showing no growth when tested according to ASTM G 21.
 - b. Shrinkage: Not greater than 0.1 percent according to ASTM D 1204.
 - c. Stretch Factor: Not less than 0.4 percent according to ASTM D 4851.
- D. Graphic Application: Vinyl film with pressure-sensitive adhesive backing.
 1. Text Message: "Building B".

- a. Text Font: Helvetica.
 - b. Character Size: Minimum 6-inch high characters.
 - c. Character Colors: To be selected by Architect.
2. Vinyl Film: Calendered-vinyl film, not less than 3 mils (0.076 mm) thick, with pressure-sensitive adhesive backing.
- E. Thread: 100 percent expanded PTFE, UV-light, mildew, and rot resistant.

2.3 AWNING FRAMES

A. Steel Frames:

1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
2. Cold-Formed Steel Tubing: ASTM A 500/A 500M, grade as required by structural loads.
3. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless another weight is indicated or required by structural loads.
4. Steel Mechanical Tubing: Cold-rolled, electric-resistance-welded carbon or alloy steel tubing complying with ASTM A 513 or steel tubing fabricated from steel complying with ASTM A 1011/A 1011M and complying with dimensional tolerances in ASTM A 500/A 500M.
5. Steel Finish: Manufacturer's standard galvanized and corrosion-resistant mill finish complying with finish manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

B. Anchors, Fasteners, Fittings, Hardware, and Installation Accessories: Complying with performance requirements indicated and suitable for exposure conditions, supporting structure, anchoring substrates, and installation methods indicated. Corrosion-resistant or noncorrodible units; weather-resistant, compatible, nonstaining materials. Provide as required for awning assembly, mounting, and secure attachment. Number as needed to comply with performance requirements and to maintain uniform appearance; evenly spaced. Where exposed to view, provide finish and color as selected by Architect from manufacturer's full range.

1. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing according to ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - a. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).
2. Adhesive-Bonded Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing according to ASTM E 1512 conducted by a qualified independent testing and inspecting agency.
 - a. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

2.4 AWNING FABRICATION

- A. Fabrics: Reinforce wear points and hardware attachment points with nonwoven webbing. Seam fabrics in locations indicated on the Drawings and as follows:
 - 1. Fabric Edges and Seams: Adhesively bonded.
 - 2. Fabric Edges and Seams: Manufacturer's standard hemming and seaming methods.
- B. Frames: Preassemble awning frames in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
 - 1. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
 - 2. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
 - 3. Weld corners and connections continuously. Obtain fusion without undercut or overlap. Remove welding flux immediately. At exposed corners and connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
 - 4. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications in place and to properly transfer loads.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for supporting members, blocking, inserts, installation tolerances, lighting, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install awnings at locations and in position indicated, securely connected to supports, free of rack, and in proper relation to adjacent construction. Use mounting methods of types described and in compliance with Shop Drawings and fabricator's written instructions.
- B. Install awnings after other finishing operations, including joint sealing and painting, have been completed.
- C. Attach fabric to frames as recommended by fabricator, using lacing method as required to conceal ends of lacing to ensure tight, wrinkle-free fit of fabric to frame.
- D. Weld frame connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
 - 1. Field Welding: Comply with the following requirements:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.

- c. Remove welding flux immediately.
 - d. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- E. Anchoring to In-Place Construction: Use anchors, fasteners, fittings, hardware, and installation accessories where necessary for securing awnings to structural support and for properly transferring load to in-place construction.
- F. Coordinate awning installation with flashing and joint-sealant installation so these materials are installed in sequence and in a manner that prevents exterior moisture from passing through completed exterior wall and roof assemblies.
- 3.3 ADJUSTING
- A. Adjust hardware and moving parts to function smoothly, and lubricate as recommended by retractable-awning manufacturer.
- 3.4 CLEANING AND PROTECTION
- A. Touchup Painting: Immediately after erection, clean field welds, connections, and abraded areas. Paint uncoated and abraded areas with same or compatible material as used for shop-applied finish painting.
- 1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
- B. Galvanized Surfaces: Clean field welds, connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 107313

SECTION 27 0005 – COMMUNICATIONS GENERAL PROVISIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. The General Conditions, Special Conditions, Instruction to Bidders and all applicable portions of Division 1 – GENERAL are part of this Section as if written in full herein. Contractor is held to have familiarized himself with these provisions contained therein.

1.02 DESCRIPTION OF WORK

- A. This Division shall include all labor, materials, equipment and services necessary for all communications work, consisting of complete copper and optical fiber cabling, termination, cross-connecting, grounding and bonding, build-out of spaces, etc. for a complete communications system installation.
- B. The Contractor shall furnish and install all cables and equipment to make a complete and working physical layer system as indicated on associated technology plans and specifications. This shall include all cabling requirements from the service provider entrance demark to and including work area outlets, etc. The Contractor shall furnish all necessary outlets, cross-connects, connections to equipment, etc. including equipment furnished under other Divisions of this Contract.
- C. The Contractor shall carefully read the general and specific conditions attached hereto, which, with the following specifications and complete working drawings, details and addenda, govern all work under this Contract.
- D. All communications work for this project is described in the specifications or shown on the drawings.
- E. The Communications Contractor shall be responsible for furnishing all materials and labor to install and accomplish all work hereinafter described. This shall include all excavation, backfill, tamping, compaction, bases, concrete work, supports, braces, steel, inserts, anchors, chases, sleeves, holes, surveying, etc. to accomplish all phases of the communications contract, without relying upon other trades or inferring anything that is mentioned in other Divisions of the specifications, unless it is specifically stated in the Communications Specifications or noted on the drawings that it is to be furnished or provided by others.
- F. If a specific item, such as a cable tray, is specified on both the communications and electrical drawings, the Communications Contractor shall include all items in his bid price, regardless of the other trades. Resolution will be by Addendum or

Change Order.

- G. Site Visitation: Examination of the site shall be made by this Contractor, who shall compare it with the drawings and specifications and shall satisfy himself as to all the conditions under which the work is to be performed. Contractor shall ascertain and check the location of any existing structures or equipment which may affect this work.
- H. It shall be the responsibility of this Contractor to refer to any discrepancies upon examination of the site and/or drawings to the Engineer/Architect before bid due date.
- I. No variances, changes, substitutions or extras will be permitted because of the Contractor's unawareness of existing conditions.
- J. No allowances shall be made on his behalf for any extra expense due to failure or neglect on his part to make such examination.

1.03 DRAWINGS

- A. The drawings accompanying these specifications are complementary to them. What is called for by one shall be considered as though called for by both, unless specifically stated or shown otherwise.
- B. The wiring layout is schematic and the exact locations shall be determined by structural and other conditions. This shall not be construed to mean that the design of the system may be changed. It refers only to the exact locations of conduits and equipment to fit into the building as constructed and the coordination of conduit and other equipment with piping and equipment included under other Divisions of the specifications.
- C. The exact location of conduits and equipment not located by dimensions on the drawings shall be determined in the field considering interferences and appearance. Minor changes in the location of equipment from that shown on the drawings shall not constitute a reason for extra charges.
- D. The drawings illustrate the work specified and are intended to agree in every respect with one another and with these specifications. All discrepancies that appear shall be brought to the attention of the Engineer/Architect for correction. No omission from any drawings shall release the Contractor from furnishing equipment or materials called for by the specifications or other drawings.
- E. The Contractor shall consult both floor plans and risers when taking "counts" of devices, such as communications outlets, racks, patch panels, cross-connect blocks, etc.

- F. The Contractor shall consult approved casework shop drawings before rough-in.
- G. Wherever the words "install" or "provide" is used, it shall be interpreted as meaning "furnish and install" unless otherwise noted.

1.04 EXISTING INSTALLATIONS

- A. The drawings indicate major items to be removed, such as racks, panels, cross-connect fields, conduit trays, etc. The drawings may not detail removals of minor devices, outlets, cables, etc. unless specifically indicated for reuse.
- B. All removed salvageable material, as determined by the Owner, shall remain the property of the Owner and shall be stockpiled on the site as directed.
- C. The Contractor shall rework the existing communications equipment and system as shown on the drawings to accomplish the indicated work.
- D. All conduit, cabling, outlets, cross-connects, racks, cabinets, panels, etc., no longer remaining in service shall be removed. Existing conduits may be reused where practical. No cabling, conduit, or equipment removed from the present installation shall be reused unless specifically indicated for reuse elsewhere.
- E. All new raceways shall be run concealed wherever possible. Where specifically indicated, new cabling may be "fished" in existing walls, utilizing approved "box eliminators". Surface mounted raceway as indicated may be utilized, complete with approved accessories, only where necessary and approved by the Engineer. Unless noted otherwise, surface mounted raceway shall be metallic.
- F. All abandoned conduit shall be removed where exposed, and shall be properly cut-off flush and plugged where concealed. All abandoned cabling shall be removed.
- G. The Communications Contractor shall provide all necessary pathways, including conduit, cable tray, j-hooks, raceways, pull boxes, etc. to extend usable existing and provide new raceway and pathways.
- H. The plans and specifications are intended to include everything obviously necessary for the entire completion of the work under this Contract. Accordingly, all work is to be done to provide a complete installation in accordance with the plans and specifications, whether each item is mentioned herein or not.
- I. The Contractor shall consult all project drawings which may affect the project to insure coordination. Other than minor adjustments shall be submitted to the Engineer/Architect for approval before proceeding with the work.
- J. Removals of communications equipment shall include removal of all supports,

fasteners, anchors, brackets, etc. for the equipment being removed. The Contractor shall include patching and painting to restore to original condition after removal.

- K. The Contractor shall verify, sort and dispose of all items removed that contain hazardous waste materials. The disposals shall be performed in accordance with EPA and local standards.

1.05 COORDINATION WITH WORK OF OTHER TRADES

- A. This Contractor shall examine work of other trades which comes in contact with or is covered by his. He shall, in no case, attach to, cover up, or finish against defective work. This Contractor shall consult all drawings and details, both architectural and mechanical.
- B. The Contractor shall likewise coordinate his work with other trades such that the work of other trades does not hinder the installation and routing of communications raceways and pathways and does not hinder or block access to the same.
- C. All outlets shall be centered with regard to paneling, trim, equipment, etc.
- D. Failure to observe this requirement will result in correction to be made at the expense of this Contractor. This Contractor shall furnish and install appropriate sleeves and hangers required in his work.
- E. See Specification Section 27 0015 – Coordination of Work Results for Communications.

1.06 BASIC MATERIALS

- A. All materials shall be of best quality, new and approved by Underwriters Laboratories, Inc. where such approval is applicable. Materials specified by manufacturer's catalog number shall be as specified unless "or Engineer Approved equal" substitutions are authorized in writing by the Engineer/Architect.
- B. Should the Contractor desire to furnish materials or equipment by manufacturers not named in the Contract Documents, he shall request permission to substitute. The Contractor shall furnish such drawings, specifications, performance data, samples and other information as may be required to assist the Engineer/Architect and Owner in determining whether the proposed substitution is acceptable.
- C. Approval of requests for substitution of products or processes other than those specified will be contingent upon submission of proof, satisfactory to the Engineer/Architect and Owner, that:

1. The proposed substitute is equal or superior in quality and serviceability to the specified products or processes.
 2. Its use will not entail changes in details and construction or in design and artistic effect.
 3. The Contractor will provide the same warranty for the substitution that he would for the product specified.
- D. All requests for substitutions shall be submitted to the Engineer/Architect no later than 14 days before bid due date.
- E. It is to be emphasized that the Contractor's base bid shall be based on equipment named in the specifications. Submission of substitute items of equipment by any bidder, contractor or manufacturer shall be in no way binding on the Owner or Engineer/Architect for acceptance or rejection. Final approval of all equipment and materials shall be made only after final test and acceptance of the project.

1.07 QUALITY ASSURANCE CODES, STANDARDS, PERMITS AND SYMBOLS

- A. Imposed Codes and Standards: Applicable provisions of the following codes and standards are hereby imposed on a general basis for the electrical work in addition to specific applications specified by individual work sections of these specifications.
1. ACIL American Council of Independent Laboratories
 2. ANSI American National Standards Institute
 3. ASTM American Society for Testing & Materials
 4. AWS American Welding Society, Inc.
 5. FM Factory Mutual Engineering Corp.
 6. FS Federal Specification (General Services Admin.)
 7. MIL Military Standardization Documents
 8. NEC National Electrical Code (NFPA No. 70)
 9. NEMA National Electrical Manufacturers Association
 10. NFPA National Fire Protection Association
 11. OSHA Occupational Safety & Health Administration
 12. UL Underwriters' Laboratories, Inc.
- B. Tests and Permits: Contractor shall demonstrate by means of tests, visual inspections, permits, certifications, the compliance of the installation with the specifications, drawings, the National Electrical Code, Local Codes, National Standards, and accepted standards of good workmanship, at the request of the Engineer/Architect and Owner. These tests shall include visual inspections,

electronic cable certification, grounding resistance and continuity measurements, and active equipment operation. All labor and testing equipment for the performance of these tests shall be furnished by the Contractor unless noted

otherwise.

- C. The Contractor shall pay for, and provide all permits required for the execution of his work.

1.08 SUBMITTALS

A. Shop Drawings:

1. Submit eight copies of detailed shop drawings of all items of equipment furnished under this Contract for approval, before manufacture of the equipment or its incorporation in the work. Drawings shall be submitted covering cable, connectivity, pathways, hardware, labeling, etc.
2. Shop drawings will not be reviewed by the Engineer/Architect if the Contractor's stamp and initials are not on the drawings showing that the Contractor has first approved drawings.
3. If quantities appear on the drawings, they will be marked out. The Engineer/ Architect will not approve quantities. This is the Contractor's responsibility.
4. If standard catalog sheets containing numerous numbers, such as cable types, are submitted without being marked for identification, they will be returned for resubmission.
5. Shop drawings of active components and electronic equipment shall include frontal and rear elevations indicating mounting details, connections, connection fields, air intake and exhaust ports and dimensions. Submittals shall include all operational specifications; including but not limited to voltage, circuit amperage, power consumption, air flow, temperature range, temperature rise, noise, etc.
6. Shop Drawings of Equipment Furnished by Others: The Contractor will be provided with complete manufacturers detailed shop drawings, wiring and connection diagrams of all equipment to which his work connects. It shall be the Contractor's responsibility to obtain the drawings from other Contractors or suppliers at the time they are needed. Work that must be altered because of the Contractor's failure to obtain shop drawings shall be corrected without additions to the Contract Price.

B. ELECTRONIC FORMAT:

1. Shop drawings may be submitted in electronic format utilizing PDF files. The submittal shall be organized by specification section and contain all required information within a PDF document for each specification section.

The submittal shall be organized as follows:

- a. Primary zip file contains a PDF of master transmittal cover page indicating the project name, submitting contractor, contact information and a list of all the sections with titles being submitted. This primary file shall also contain each of the individual PDF files for the individual sections being submitted.
- b. Sub PDF file for each specification section organized as follows:
 - 1) First Page: Cover page indicating the project name, submitting contractor, contact information, space for Engineer's stamp.
 - 2) Page(s) for contractor qualifications and project certifications.
 - 3) Page(s) for Bill of Materials (BOM) list including part numbers, quantities and references to specification section paragraphs for each part.
 - 4) Page(s) for manufacturer's data sheets.
 - 5) Page(s)/Drawing(s) for system diagrams, riser diagrams, block diagrams, etc.
 - 6) Drawing(s) for floor plans showing equipment locations.

C. Material List:

1. The successful Contractor shall upon award of the Contract, submit a material list for approval to include but not be limited to the following items. Eight copies of the list shall be submitted.
 - a. Cables
 - b. Connectors
 - c. Adapter/Couplers
 - d. Patch Panels
 - e. Cross-Connect Blocks
 - f. Cable Tray/Accessories
 - g. Ladder Rack/Accessories
 - h. J-Hooks/Hangers
 - i. Conduit/Accessories
 - j. Wireway/Accessories
 - k. Cable Management
 - l. Cable Organizers
 - m. Dropouts
 - n. Spill Ways
 - o. Faceplates
 - p. Labels/Nameplates
 - q. 106/104 Frames

- r. Outlet Boxes/Devices
 - s. Surface Raceway/Accessories
 - t. Box Eliminators
 - u. Ties and Wraps
 - v. Entrance Protection
 - w. Surge Protection
 - x. Enclosures/Cabinets
 - y. Equipment Racks/Accessories
 - z. Grounding/Bonding Devices
 - aa. Anchoring/Mounting Hardware
 - bb. Cross-Connect Frames/Fields
- D. See Specification Section 27 0012 – Required Submittals for Communications.
- E. Record Drawings:
- 1. The Contractor shall keep in the field, and open to inspection, an accurate, current, progressive record of the actual installation of the communications system. On completion of the work, the Contractor shall deliver marked prints showing the actual routing of the conduits, cable trays, major open wiring runs, pull boxes, etc. and elevations, outlet identification numbers, connectivity, outlet elevation, sleeves, firestopping, riser conduits/sleeves, cable support, grounding bus bars, bonding backbone, etc.
- F. Operating Instruction Manuals:
- 1. Provide written instructions for each system listed in the specifications.
 - 2. Submit two (2) copies to the Engineer/Architect for approval.
 - 3. After approval, submit four (4) copies to the Engineer for delivery to the Owner.
 - 4. Bind the written operating instructions, shop drawings, equipment catalog cuts and manufacturer's instructions into a hardback binder where they can be accommodated into 8-1/2 inch x 11 inch size. Material to be assembled as follows:
 - a. First Page: Title of job, Owner, address, date of submittal, and name of Contractor.
 - b. Second Page: Index
 - c. Third Page: Introduction to first section containing a complete written description of the system.
 - d. First Section: Written description of system contents, where

actually located in building, how each part functions individually, and how system works as a whole. Conclude with a list of items requiring service and either state the service needed or refer to the manufacturer's data in the binder that describes the proper service.

- e. Second Section: Manufacturer's instruction.
 - f. Third Section: Shop drawings and equipment catalog cut sheets.
- G. Record drawings and operating instruction manuals must be submitted before final payment is approved.

PART 2 - PRODUCTS

2.01 PRODUCTS, DATA/TELECOMMUNICATIONS WORK

- A. It is to be emphasized that the Contractor's Base Bid shall be based on equipment named in the specifications. Submission of substitute items of equipment by any Bidder, Contractor, or Manufacturer shall be in no way binding on the Owner or Engineer for acceptance or rejection. Final approval of all equipment and materials shall be made only after final test and acceptance of the project.

PART 3 - EXECUTION

3.01 GENERAL

- A. Perform all work in accordance with the latest edition of the National Electrical Code, OSHA, state and local codes which apply.
- B. All workmanship shall be in accordance with the best practices of the trade. Communications work shall be installed by journeyman technicians under the direct supervision of a competent foreman. At no time shall communications work be without the immediate on-the-job supervision of a journeyman technician.
- C. All communications workmanship shall be in accordance with the specifications, equal or exceed the best practices of the trade and TIA standards. All communications work shall be installed by journeyman communications installers under the direct supervision of a certified technician foreman. At no time shall communications work be performed without the immediate on-the-job supervision of a certified technician.
- D. This Contractor shall at all times keep himself fully informed of the progress of the general construction and shall install all of his work that is concealed and built into the building in place in sufficient time to insure proper location without delays in the work of the other trades. Properly attend the communications work

during the progress of the building-in to prevent misalignments or damage to the communications work.

- E. Cutting through floors and into columns, walls or partitions made necessary in order to install this work must be done under the direction of the Engineer, and only with the Engineer's written approval. All cutting of masonry fireproofing made necessary for the installation of communications work shall be repaired by this Contractor as directed by the Engineer.
- F. Upon completion of work, the entire installation will be inspected and tested to see that the requirements of these specifications have been fully complied with before the final payment will be approved.
- G. Penetration of metal roof deck is not permitted for hangers, clamps, fasteners, etc.
- H. In areas without suspended ceilings, items located between structural members shall be supported from unistrut.
- I. Provide all additional supplementary support as may be required. All supports shall be by an approved system such as "unistrut". Supports composed of channel iron, conduit, wire or other non-approved material shall not be acceptable.
- J. Prepare all fittings, boxes, supports and panels exposed for painting by removing all oil, grease and dirt. Employ the necessary precautionary methods to prevent scratching or defacing of all communications apparatus and devices.
- K. Exposed conduit installed after room has been painted shall be painted to match room finish by this Contractor.
- L. No conduits, cables, boxes, devices, etc. shall be attached to wires that support ceiling suspension system.
- M. All communications devices, etc. attached to or suspended from grid ceilings shall be supported from the main T-bars, not the intermediate T's.
- N. Install conduit expansion fittings (O.Z. Gedney or approved equal) at all conduits passing through building expansion joints.
- O. Install cable barriers with sealing block assemblies (Crouse-Hinds, Nelson, or 3M) at all cable tray penetrations of fire-rated walls or floors.
- P. Openings around conduits or in sleeves for conduits penetrating fire-rated floor slabs, walls, partitions, ceilings or smoke partitions, shall be sealed at both sides of the penetration. Mineral wool shall not extend through sleeves. Fiberglass is

not acceptable.

- Q. The Contractor shall verify with the Architect and/or the local building authority, the fire rating requirements of any wall or floor to be breached by a conduit, cable, raceway or other penetration as per ASTM E-119 (NFPA-251 and UL-263) standards. The Contractor shall notify the Engineer, Architect and Owner in writing of all existing non-compliant conditions for resolution. The presence of existing non-compliant conditions will not exempt the Contractor from meeting the installation fire rating requirements.
- R. The Contractor shall provide through penetration firestops as per ASTM E-814 and UL-1479. Firestop systems shall have been tested by UL and meet the rating criteria, as published in the UL Fire Resistance Directory. Contractor shall consult individual manufacturer's instructions for specific application details.
- S. All firestopping systems shall be of a single manufacturer, as manufactured by 3M, Nelson, Specified Technologies, Hilti, ABESCO or Engineer approved equal. Contractor shall submit cut sheets with authority having jurisdiction approval to the Engineer for review and acceptance.
- T. The Contractor shall rough-in and completely connect up, after equipment installation by others, all equipment as detailed on the drawings and specified herein. It shall be the responsibility of the Contractor to verify exact locations of outlets serving various equipment units, as well as connectivity requirements. Provide a permanent, supported and protected outlet with outlet patch cord.
- U. The Contractor shall use all care possible to avoid soiling the floors and walls. No cutting, threading, or bending of conduit will be permitted in building areas where finished floors have been installed, unless the floors are covered or protected. If floors are damaged, they shall be refinished to the satisfaction of the Engineer/Architect.
- V. Nameplates: Provide nameplates on all equipment of the type listed in the following schedules:
1. Equipment Racks
 2. Equipment Cabinets
 3. Patch Panels
 4. Cross-Connect Fields
 5. Grounding Bus Bars
 6. Pull Boxes
 7. Control Panels (i.e. PBX)
 8. Control Devices (i.e. AP)
 9. Power Outlets, Distribution and Busway
 10. Entrance Protection/Surge Protection
 11. Surge Protection

Lettering shall include name of equipment, the specific unit number, and any reference to "ON"- "OFF" or other instructions that are applicable.

- W. Nameplates shall be laminated phenolic with a white surface and black core. Items connected to an emergency power source shall have a red surface and white core. Use 1/16 inch thick material for plates up to 2 inch x 4 inch; for larger sizes use 1/8 inch thick material.
- X. Lettering shall be condensed Gothic. The space between lines shall be equal to the width of the letters. Use 1/4 inch minimum height letters which occupy four to the inch. Increase letter size to 3/4 inch on the largest plates.
- Y. Warranty: This Contractor shall warranty his entire communications installation against defects in workmanship and materials for a period of two (2) years after the date of acceptance by the Owner, ordinary wear and tear excepted, or such longer period as specified in the Contract Documents. Upon written notice from the Owner this Contractor shall remedy all such defects at his own expense and at a time convenient to the Owner.
- Z. Inspections: This Contractor shall, at the conclusion of the installation secure a Certificate of Inspection, properly signed by the Controlling Building Department which shall state that all codes have been complied with and the work is satisfactory. The Contractor shall give notice to the proper authorities in ample time so that work can be inspected and approved as it progresses.
- AA. Immediately correct all work which is found unacceptable by the Engineer/Architect; work shall be considered unacceptable when it is contrary to the Drawings and/or Specifications and/or the National Electrical Code and/or accepted standards of good workmanship.
- AB. Noise Limitation: Perform all work to assure minimal noise produced by the communications equipment and installation.
- AC. Check and tighten all plates, covers, doors, and trims used in conjunction with communications equipment. All outlet openings not receiving a device shall be provided with a blank plate. There shall be no "open" boxes.
- AD. Remove and replace any device or equipment which is found to emit noise level higher than industry standards. Perform all work in accordance with the field instruction issued by the Engineer/Architect to alleviate such conditions.
- AE. Upon completion of the work, the Contractor shall remove all debris, tools, machines, etc. pertaining to this work from the general area and shall leave the area broom clean. The Contractor shall be responsible for maintaining clean and safe conditions in the work areas.

- AF. Communications spaces (i.e. entrance facilities, equipment rooms, tele/communications room, etc.) shall be completed with dirt and dust generating tasks, the space and all surfaces cleaned and dust free, sealed (i.e. painted, gasketed), up to 30 days prior to job completion and before start of termination and electronic equipment installation. Contractor to verify the construction schedule.
- AG. The Contractor is responsible to maintain the cleanliness of the communications spaces.

END OF SECTION 27 0005

SECTION 27 0012 – REQUIRED SUBMITTALS FOR COMMUNICATIONS

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK:

- A. Prepare required submittals of contractor qualifications, references, certifications, registrations, cut-sheets, shop drawings, etc. in a timely manner and submit to the Owner/Engineer for review and approval prior to the start of work or installation as indicated on the Drawings, specified or as otherwise required.

PART 2 – PRODUCTS AND MATERIALS

2.01 REQUIRED SUBMITTALS SHALL INCLUDE, BUT NOT BE LIMITED TO THE FOLLOWING:

- A. Primary Contractor identification and all proposed Subcontractor identifications shall be provided at the time of the bid submittal.
- B. Contractor qualifications, registrations, certifications, references, etc. shall be provided within three (3) working days after the bid opening and notification of low bidder by the Owner/Engineer.
 - 1. Ten (10) working days shall be allocated for the review and confirmation of the Contractors qualifications.
- C. Complete documentation regarding the manufacturer's warranty and guarantee shall be submitted within three (3) working days after the bid opening. This shall include but not be limited to: A completed and signed copy of the manufacturer's warranty that will be provided to the Owner upon installation completion and acceptance, and shall document the support procedures for warranty issues.
 - 1. The manufacturer shall provide a "Letter of Intent" to the Owner stating manufacturer's intent to maintain the Contractor as a registered and certified installer, authorized to support and maintain the installation for the duration of the Warranty period.
- D. Contractors tradesman registrations and certifications shall be provided within five (5) working days of commencement of work or the presence of the tradesman on the job site.
 - 1. Three (3) working days shall be allocated for the review and confirmation of the tradesman's qualifications.
- E. Cable Factory Master Reel Test Reports shall be provided within two (2) working days of the material arriving on the construction site.

1. Three (3) working days shall be allocated for the review and acceptance of the Master Reel Test Reports.
 2. Concurrent with the submittals of the Master Reel Reports for the fiber optic cable, the Contractor shall submit a Memo of Compliance and Acceptability for the Contractor performed "Fiber Optic Pre-Installation" tests for the cables as received.
- F. Submit eight (8) sets of shop drawings for specified data/telecommunications materials and equipment proposed for use on the project. Shop drawings and cut sheets shall be submitted, approved and returned prior to purchase and installation of the material and equipment.
1. Shop drawing submittal shall include, but not be limited to the following:
 - a. Cables – Copper, Fiber, Coaxial, Horizontal, Backbone
 - b. Connectivity – Copper, Fiber, Coaxial
 - c. Equipment Racks – 2 Post/ 4 Post & Accessories
 - d. Equipment Cabinets & Accessories
 - e. Power Strips, PDU Strips, Etc.
 - f. Floor Boxes, Floor Raceway, Ceiling Boxes, MUTOAs, Consolidation Points, Etc.
 - g. Patch Panels, Face Plates, Adapter Plates, Cassettes, Etc.
 - h. Cross-Connect Blocks
 - i. Cable Tray & Accessories
 - j. Cable Ladder & Accessories
 - k. J-Hooks, Cable Ties, Cable Wraps
 - l. Surface Mounted Raceway – Metallic/Non-Metallic
 - m. Fiber Interconnect Cabinets & Accessories
 - n. Splice Enclosures & Accessories
 - o. Inner Duct
 - p. Vertical/Horizontal Cable Organizers
 - q. Ground Bus Bars, Lugs, Hardware, Conductors
 - r. Conduit, Sweep Bends
 - s. Pull Boxes
 - t. Condulete Fittings
 - u. Conduit Plugs & Seals
 - v. Patch Cords – Copper, Fiber, Cross-Connect Wire
 - w. Pigtail Assemblies, Pre-manufactured Cassettes, Etc.
 - x. Test Equipment – Copper, Fiber, Coaxial, Grounding
 - y. Specialized Tooling – Fiber Cleaver, Inspection Scope, UFL, Fusion Splicer, Insertion Tools, Etc.
 2. Shop drawing submittals shall indicate full compliance with all specified requirements. Shop drawings not indicating full compliance; will be returned unapproved for re-submittal.

3. Shop drawing submittals shall be marked to indicate the specific item or items being submitted with a complete description noted, options selected, etc. Copies of general catalog pages, advertisements, etc. are not acceptable. Shop drawings not indicating full compliance or complete information will be returned, unapproved for re-submittal.
 4. Shop drawings shall be submitted within ten (10) working days of the award of contract. Ten (10) working days shall be allocated for the review and approval of the shop drawings by the Owner and Engineer.
- G. The Contractor shall submit a minimum of thirty (30) days prior to commencement of installation, or as otherwise directed, for Owner and Engineer review and acceptance, drawings indicating cable tray, conduit or other raceway routing, size, cable fills, etc. to verify that the installation will meet all aspects of the Specification.
1. The submittal shall assure that the Contractor has verified the route, verified fire barrier penetrations, confirmed the application of the raceway system, verified the cable counts, raceway size and cable fill, etc. and as a result all project goals and intents of the design and Specifications shall be able to be met.
- H. The Contractor shall submit to the Owner and Engineer cut-sheets for fire-stopping materials and assemblies, which have been reviewed and approved by the Local Authority Having Jurisdiction (AHJ) for review and acceptance by the Owner and Engineer.
1. The submittals shall be provided within a minimum of five (5) working days prior to installation for review and acceptance by the Owner and Engineer, or as otherwise directed.
- I. The Contractor shall submit within a minimum of ten (10) working days prior to commencement of cable testing, the names, registrations, and certification of the proposed cable testing team technicians. The submittal shall verify a thorough knowledge, understanding, training and experience of the equipment to be utilized, and a proficiency in its operation. The Contractor shall provide a written detailed equipment set-up procedure, indicating "what and how" all test parameters are entered into the test or equipment; factory default settings are not acceptable. The approved set-up procedures will be provided to the owner as a component of the final cable test submittals, providing the Owner documentation with all information required to duplicate the original test conditions and parameters.
1. Cabling plant verification testing shall be performed by Owner and Engineer approved technicians only, all test results performed by others will be rejected by the Owner and Engineer, and re-tested as per

Specifications. Testing performed by others than Owner and Engineer approved personnel, whether under "supervision" or not, will be rejected and re-tested per Specifications at the Contractors expense.

2.02 AS-BUILT DRAWINGS:

- A. The Contractor shall provide final "as-built" drawings for the project.
- B. "As-Built" drawings shall indicate, but not be limited to the following:
 - 1. Final location of all equipment, racks, etc.
 - 2. Final routing of all major pathways, conduits, cable trays, etc.
 - 3. Final location of all splice enclosures, pull boxes, hand-holes, man-holes, equipment rooms, etc.
 - 4. Final location of all outlets, W.A.P., tel-comm grounding, etc.
 - 5. Final labeling information and identifiers on all outlets, equipment, pathways, cross-connect fields, etc.

2.03 CLOSE-OUT DOCUMENTS:

- A. The Contractor shall provide the following closeout documentation as directed by the Owner and Engineer as per the Construction Documents:
 - 1. Instruction Manuals for all equipment provided
 - 2. Approved Shop Drawings, Submittal Drawings, Sketches
 - 3. As-Built Drawings
 - 4. Electronic copy of all final, accepted copper cable test results
 - 5. Electronic copy of all final, accepted fiber optic cable test results
 - 6. Third party partnership registration and certification documentation

PART 3 – EXECUTION

- 3.01 All submittals, excluding shop drawings and "close-out" documents shall be made directly to the Owner and Engineer in writing (e.g. with Letter of Transmittal itemizing the content) as per the construction documents.
 - A. Shop drawings and "close-out" documents shall be submitted directly to the Engineer and Owner's Representative as per the construction documents.

END OF SECTION 27 0012

SECTION 27 0015 – COORDINATION OF WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 01 Specifications Sections, apply to this section.

1.02 DESCRIPTION OF WORK

- A. Coordination of work by the Communications Contractor with the Owner, Architect, Construction Manager, General Contractor and other trades to assure a complete, timely, functioning communications installation per the drawings, specifications and industry standards.

1.03 CONTRACT DRAWINGS

- A. The drawings accompanying these specifications are complementary each to the other and what is called for by shall be as if called for by both.
- B. Consult all Contract drawings that may affect the location of equipment, and cabling and make minor adjustments in location to secure coordination.
- C. Coordinate layout of work with other trades. Make minor adjustments in location required for coordination.
- D. Other than minor adjustments shall be submitted to the Construction Manager for approval before proceeding with the work.
- E. The location of outlets shown on the drawings is approximate, and the Architect shall have the right to relocate any outlets before they are installed without additional cost.

1.04 SHOP DRAWINGS

- A. All trades shall submit to the Construction Manager, for use by the Communications Contractor, manufacturer's shop drawings for all equipment and materials that may affect the communications installation.
- B. Trades shall thoroughly review each submittal and indicate the exact item to be furnished. Each submittal shall be stamped with the Contractor's approval before submitting to the Construction Manager.
- C. Engineer's review of manufacturer's drawings or schedules shall not relieve the Contractor from responsibility for errors or omissions in manufacturer's drawings

or schedules and deviation from Engineer's drawings or specifications.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. All materials shall be new and undeteriorated and of a quality not less than the minimum specified.
- B. Materials and equipment for which there are Underwriters' Laboratories Standard requirements, listing and labels, shall have listing of Underwriters' Laboratories and be so labeled.

2.02 QUANTITIES

- A. Items may be referred to as singular or plural on the drawings and in the specifications. The Contractor is responsible for determining quantity of each item required.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Furnish and install all necessary hangers, supports, straps, and other similar appurtenances not indicated on the drawings but which are required for a complete and properly installed system consistent with the Architectural treatment of the building.
- B. Contractor shall inform him/herself fully regarding peculiarities and limitations of space available for installation of materials and apparatus under this contract, and see that all equipment necessary to be reached from time to time for operation and maintenance are made easily accessible.

3.02 COORDINATION

- A. Coordinate with the Architect and Architectural drawings walls, floor and ceiling construction and ratings:
 - 1. Wall Construction: Masonry, stud and drywall, furred, etc. Verify fire rating.
 - 2. Floor Construction: Wood and joist, concrete slab on grade, concrete on metal pan, pre-stressed concrete plank. Verify fire rating.
 - 3. Ceiling Construction: Suspended ceiling, drywall on metal truss work, open to deck or plank above. Verify fire rating and environmental rating.

- B. Coordinate with Architectural and Structural Elevations and Sectional Plans. Verify environments, pathways, routes, etc.
1. Coordinate pathway routes through structure, verify accessibility and clearances.
 2. Identify structural and architectural obstructions; verify access to risers and chases.
 3. Avoid stairways, elevator shafts, HVAC shafts, Electrical Rooms, Elevator Equipment Rooms, Mechanical Rooms, etc.
 4. Avoid spaces with high, architectural ceilings. Coordinate access points/panels/doors in hard ceilings.
 5. Verify the 90-meter horizontal cable length limitation.
 6. Verify communication spaces for size and dimensions as adequate to house equipment expected and meet minimum NEC clearances and working space.
 7. Coordinate all in-slab or below slab on grade conduits. Conduits below the vapor barrier are considered exterior conduits and require the placement of OSP cables. Verify with the local AHJ.
 8. Coordinate the cutting, drilling, tapping, etc. of any structural member with the Architect and Structural Engineer.
 9. The location of communications outlets shown on the drawings is approximate, and the Architect shall have the right to relocate outlets before they are installed without additional cost.
 10. Coordinate location of communications outlets with casework shop drawings. Verify casework pathways and clearances.
 11. Coordinate locations of communications outlets with Architectural details. Verify and coordinate construction details.
- C. Coordinate with the Mechanical Contractor and the Mechanical drawings, the location, elevations and routing of all mechanical ductwork systems and equipment.
1. Generally mechanical ductwork should be as high as possible, providing maximum space below for other systems.
 2. Communications pathways and equipment shall not hinder access to mechanical equipment.

3. Only mechanical system ductwork specifically dedicated to the Communications Room should enter the communications space.
 4. Dedicated HVAC equipment suspended from the ceiling above shall be as high as possible and not located above communications equipment and pathways.
 5. Wall mounted HVAC equipment shall not be located above communications equipment or cross-connect/termination fields.
 6. Condensate drain lines shall be as short as possible and not route over communications equipment or pathways.
 7. Whenever possible dedicated HVAC equipment should be located outside the Communications Room or a vertical unit should be located in a "dead" corner of the space.
- D. Coordinate with the Plumbing Contractor and Plumbing drawings the location, elevation and routing of all plumbing system piping, lines and equipment.
1. Generally plumbing lines and piping are afforded priority right-of-way routing to maintain required slope.
 2. Plumbing system piping and lines should be routed as high as possible, shall not be routed over or hinder access to communications pathways and equipment.
 3. Communications pathways and equipment shall not hinder access to plumbing system devices and equipment.
 4. Plumbing systems piping, lines and equipment shall be routed around and not enter or pass through communications spaces.
 5. Plumbing traps, cleanouts, valves and other devices shall not be located in communications spaces.
- E. Coordinate with the Electrical Contractor and Electrical drawings the location, elevation and routing of all electrical system conduits, cable trays, bus ducts, equipment, etc.
1. Generally electrical system conduits and cable trays should be as high as possible, providing maximum space below for other systems.

2. Communications pathways and equipment shall not hinder access to the electrical system and equipment.
 3. Electrical system conduits, cable trays, bus ducts, equipment, etc. shall not hinder access to the communications system pathways and equipment.
 4. Contractors shall coordinate pathways and equipment locations and routing to maintain minimum clearances as specified elsewhere in the specifications.
 5. Contractors shall coordinate pathway use and the pathway corridor utilization.
 6. Contractors shall coordinate the location of electrical equipment, outlets, lighting and services in all communications spaces.
 7. Contractors shall coordinate the location of conduits, sleeves, cable tray, cable ladder for communications and the communications grounding system, when provided by the Electrical Contractor.
 8. Dedicated electrical distribution panels for communications spaces should be located in the space, adjacent to the door. The panel should be provided with a main circuit breaker with 2 Form C auxiliary contacts and shunt trip functions.
 9. Step-down transformer, ≤ 15 kVA for the dedicated panel may be suspended as high as possible from the ceiling above 108" AFF, ≥ 15 kVA transformers shall be located in the Electrical Room. Maintain electrical clearance from communications equipment and cabling.
 10. The dedicated electrical distribution panel for communications should have onboard surge protection provided.
- F. Coordinate with the Fire Protection Contractor and Fire Protection drawings the location, size, elevation and routing of all fire protection piping, lines and equipment.
1. Generally fire protection lines and piping are afforded priority right-of-way routing to maintain required slope.
 2. Fire protection piping and lines should be routed as high as possible, shall not be routed over or under access to communications pathways and equipment.

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3. Communications pathways and equipment shall not hinder access to fire protection piping, devices and equipment.

4. Fire protection piping, lines and equipment shall be routed around and not enter or pass through communications spaces, with the exception of dedicated lines and devices for the specific space.
 5. Fire protection piping, lines and devices located in communications spaces shall not be located over communications equipment, pathways, terminations, cross-connect fields, etc.
 6. Fire protection piping, lines and devices routed in and or through communications spaces shall be provided with integrated system of drip pans with gravity drainage.
- G. Coordinate with the General Contractor and the Construction Manager all work by all other trades to be in communications spaces, affecting communications pathways, pathway corridors, etc. and the scheduling of such work.
1. Coordination between the Communications Contractor and other trades is critical.
 2. Generally, mechanical, plumbing, electrical and fire protection systems are static systems upon completion of construction, with the exception of maintenance access functions.
 3. Generally, communications systems are active systems for the life of the facility, subject to moves, adds and changes (MAC's) from facility conception, design, construction and through the life cycle.
 4. For these reasons mechanical, plumbing, electrical and fire protection systems should be high as possible to provide maximum space below for communications and other low voltage systems.
 5. Corridors for communications pathways should be as straight as possible, located approximately 12" above the ceiling, providing a minimum 6" clearance or more from light fixtures.
 6. Open wiring in cable tray or J-Hooks requires a minimum of 6" or more clearance on all sides of the pathway for access.
 7. Pathways above hard ceilings should be in enclosed conduit, with access to pull boxes and J-boxes.
 8. Open wiring in cable tray or on J-Hooks requires 18" sq. minimum opening access doors on nominal 12' or less centers.
 9. Generally open wiring pathways above accessible ceilings should be approximately 12" above the ceiling, accessible from an 8' stepladder.

10. Furred-out walls must be capable of accepting the minimal 4-11/16" sq. x 2-1/8" deep box with plaster ring and 1" minimum conduit stub-up conduit.
11. Small bundle (1-6 cables) open wiring on J-Hooks requires 3" or more clearance on all sides of the bundle. Clearance allows for expansion and contraction of the cables.
12. Communications cable shall not lie on or across structural steel, support members, conduit, piping, ductwork, light fixtures, equipment of other trades, etc.
13. Horizontal conduits and sleeves installed by other trades shall line up with the cable tray or ladder they are mating with. Bottom of conduits and sleeves shall be level with or above the floor of the cable tray or ladder. Cable tray or ladder shall extend to within ≤ 6 " of the conduit and sleeves.
14. Vertical conduits and sleeves dropping onto cable trays and ladders, shall line up over the cable or cable ladder. There shall be a nominal 12" of clearance from the open end of the conduit or sleeve on to the tray or ladder. More clearance may be required to meet the minimum bend radius of the cable to be installed. Communications Contractor to verify.
15. Horizontal conduit and piping of other trades shall not enter or pass through communications spaces unless dedicated to the space.
16. Vertical conduits and piping of other trades should not enter or pass through communications spaces.
17. Vertical riser conduits and sleeves for communications shall be located as close to the wall as possible (1-1/2" nominal clear) and shall enter the room in the dead space behind the door.
18. If vertical riser conduits and piping of other trades must pass through the communications space, locate adjacent to the door jam and behind the door.
19. Coordination and scheduling of work by other trades is critical to the communications project.
20. Communications cabling shall not be installed or terminated until the facility is enclosed and environmentally stabilized.
21. All work by other trades in communications spaces must be completed nominally 30 days prior to turning the facility over to the Owner for

- occupancy. Address and verify time frame with the Construction Schedule.
22. Construction work by other trades in communications spaces must be complete; spaces finished, sealed from ingress of dust, cleaned to a “dust free” state, and maintained “dust free” before installation of cable termination equipment, electronic equipment and termination of cables can begin.
 23. Generally, the Owner will want to install electronic equipment and begin the “bake-in” process and operational checkout prior to occupying the facility. Concrete and plaster dust is particularly destructive to electronics and terminations.
 24. It is recommended that the communications spaces be locked and access controlled by the Communications Contractor upon establishing the “dust free” condition. Coordinate with Owner’s I.T. Department Manager.
 25. Communications grounding system shall be completed, visually inspected and tested prior to installation of electronic equipment.

END OF SECTION 27 0015

SECTION 27 0526 - COMMUNICATIONS GROUNDING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Division-27 General Provisions and Basic Materials and Methods sections apply to work specified in this section.

1.02 DESCRIPTION OF WORK:

- A. Extent of communications grounding work is indicated by drawings and schedules.
- B. Requirements of this section apply to communications grounding work specified elsewhere in these specifications.

1.03 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of electrical connectors, terminals and fittings, of types and ratings required, and ancillary grounding materials, including stranded cable, copper braid and bus, ground rods and plate electrodes, whose products have been in satisfactory use in similar service for not less than three years.
- B. NEC Compliance: Comply with NEC requirements as applicable to materials and installation of communications grounding systems, associated equipment and wiring. Provide grounding products which are UL-listed and labeled.
- C. UL Compliance: Comply with applicable requirements of UL Standards Nos. 467 and 869 pertaining to communications grounding and bonding.
- D. IEEE Compliance: Comply with applicable requirements of IEEE Standard 1100 - 1992 pertaining to powering and grounding sensitive electronic equipment.
- E. TIA Compliance: Comply with TIA-607B Standards and the BICSI Telecommunications Distribution Methods Manual (TDMM) for the installation of communications grounding and bonding systems.
- F. The installation of the communications grounding system shall be performed under the direction and supervision of the Contractor's designated Project Registered Communications Distribution Designer (RCDD) under Specification Section 27 1500.

PART 2 - PRODUCTS

2.01 MATERIALS AND COMPONENTS:

Except as otherwise indicated, provide communications grounding systems indicated; with assembly of materials, including, but not limited to, cables/wires, connectors, terminals, compression lugs, grounding rods/electrodes and plate electrodes, bonding jumper braid, surge arresters, and additional accessories needed for a complete installation. Where materials or components are not indicated, provide products complying with NEC, UL, IEEE, and established industry standards for applications indicated.

- A. The Telecommunication Main Ground Bus Bar (TMGB), unless noted otherwise shall be a Harger #GBI-14416TMGBKT or Engineer approved equal.
- B. The Telecommunication Ground Bus Bar (TGB), unless noted otherwise shall be a Harger #GBI-14412TMGBTKT or Engineer approved equal.
- C. Compression lugs and stainless steel hardware for terminating to equipment, unless otherwise noted shall be as follows, or Engineer approved equal:
 - 1. One-hole compression lug, #6 cable; Harger #GECLB6
 - 2. Two-hole compression lug, #6 cable; Harger #GECLB62A
 - 3. Two-hole compression lug, #2 cable, Harger #GECLB22C
 - 4. Two-hole compression lug, #2/0 cable; Harger #GECLB2/02C
 - 5. Two-hole compression lug, #4/0 cable; Harger #GECLB4/02C
 - 6. 1/4 – 20 x 3/4" hex head cap screw; Harger #CS46S-100
 - 7. 3/8 – 16 x 1" hex head cap screw; Harger #CS68S-100
 - 8. 1/4 – 20 x 3/4" slotted round head machine screw; Harger #MS465-100
 - 9. 1/4" star washer; Harger #SW4S-100
 - 10. 3/8" star washer; Harger #SW6S-100
 - 11. 1/4 – 20 hex nut; Harger #N4205-100
 - 12. 3/8 – 16 hex nut; Harger #N6165-100
 - 13. Antioxidant joint compound, 1/2 oz. size; Harger #HCAJC1/2
 - 14. Antioxidant joint compound, 8 oz. size; Harger #HCAJ68
 - 15. See the Harger catalog for other appropriate stainless steel hardware and compression lug part numbers.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. The Contractor shall provide a communications grounding system, providing a low impedance path to ground and a stable ± 0 volt to ground signal reference point for the communications systems equipment and infrastructures. The communications grounding system shall comply with the TIA-607 "Standard for

Commercial Building Grounding and Bonding Requirements for Telecommunications" and the IEEE Standard 1100 "Recommended Practice for Powering and Grounding Sensitive Electronic Equipment." The communications grounding system shall be as indicated on the detailed Engineering Drawings and documents, unless otherwise specified.

- B. The communications grounding and bonding system infrastructure shall originate with a low resistance connection to the electrical service entrance equipment (MDP) ground bus or “intersystem bonding termination”, and extend as an independent ground system throughout the building.**
- 1. Reference N.E.C. Article 250.94.**
- C. The connection to the electrical service entrance ground bus shall be equal in size to the electrical service entrance ground conductor to the Telecommunications (Main) Grounding Bus bar (TMGB/TGB), located in the Entrance Facility (EF) or communications equipment room, adjacent to the communications service entrance equipment as required.
1. Where the “intersystem bonding termination” conductor is of smaller size than the electrical service entrance ground conductor or the TMGB/TGB is greater than 50' from the electrical service entrance equipment, the Contractor shall provide a dedicated grounding electrode (ground rod). All grounding electrodes shall be bonded together at the earth interface, per N.E.C. Article 250.50.
- D. A communications grounding system backbone cable shall be provided, tying all Telecom Rooms (TRs), and Enclosures (TEs), etc. to a common ground point as shown. The Telecommunications Bonding Backbone (TBB) shall be equal to the electrical service entrance ground or a minimum of a #2 AWG copper conductor unless noted otherwise.
- E. The Telecommunications Bonding Backbone (TBB) shall terminate on the Telecommunications Grounding Bus bar (TGB), in the intermediate wiring closets and/or on appropriate welded ground studs/lugs in communications cabinets. Bonding and grounding conductors shall originate from the ground distribution bus bars, to all communications equipment, racks, raceways, service entrance protection, surge protection, local power distribution panels, building structural steel, etc.
- F. All bonding conductors and connectors shall be UL listed for the purpose intended. All bonding conductors shall be insulated stranded copper, minimum conductor size of #6 AWG, and colored green.
- G. Bonding and grounding conductors should not be placed in ferrous metallic

conduit. If it is necessary to place grounding and bonding conductors in ferrous metallic conduit, the conduit shall be bonded to the grounding conductor, for conduits that exceed 3'-0" in length, the conduits shall be bonded at each end to the conductor with a #6 AWG sized copper conductor minimum.

1. All metallic conduits shall be bonded to ground.
- H. Whenever two or more vertical Telecommunications Bonding Backbone (TBB) are required up through and within a multi-story building, the backbone cables shall be bonded together with an equivalent sized TBB Interconnecting Bonding Conductor (TBBIBC) at the top and bottom floors, and at a minimum of every third floor in between.
- I. The communications grounding system backbone cables and bonding conductors shall be installed without splices whenever possible. Where splices are necessary, they shall be minimal in quantity, accessible and located in communications spaces only. All splices shall be approved by the Engineer.
- J. Joined segments of communications grounding system shall be connected using only irreversible compression-type connectors, exothermic welding, stainless steel bolt, star washer and nut connections or equivalent.
- K. The Contractor shall provide oxide inhibiting joint compound on all compression, nut and bolt, and mechanical type terminations.
- L. Stainless steel machine screws, nuts, bolts and star washers shall be used for all grounding hardware and fasteners.
- M. Common zinc-clad or nickel-plated steel hardware fasteners are not acceptable. Replace all zinc-clad/nickel-plated hardware with specified stainless steel hardware.
- N. Stainless steel star washers shall be utilized, split ring washers are not acceptable (except on the ground bus bar as part of the ground bus bar kit). The star washer to be located under the nut.
- O. Setscrew type and/or box lug type terminations and split-bolt type connectors are not acceptable for the communications grounding system, replace with irreversible compression type connectors and lugs unless otherwise noted.
- P. All connections, joints and conductors shall be adequately supported and protected.
- Q. All ground distribution bus bars and grounding, and bonding conductors shall be labeled and provided with a warning legend plate of engraved phenolic, green

letters of 3/16" and 1/8" in height on a white background, sized 3" wide x 1-1/2" high, reading "WARNING - If connectors or cables are loose or must be removed - Please call the facility Telecom Manager."

- R. Grounding and bonding conductors shall be provided to all individual pieces of equipment. Daisy chaining of ground bonding conductors shall be minimized and shall be limited to similar pieces or types of infrastructure elements.
- S. Bonding conductors shall be provided between equipment elements in lieu of the unreliable physical electrical continuity through mounting means.
- T. The grounding system backbone cable shall be lugged and connected to each section of supporting cable trays, where the cable tray utilized is not U.L. listed and/or not installed as "classified as suitable as an equipment grounding conductor".
- U. Mechanical connection points to trays, ladders, frames, chassis, enclosures, etc. shall be **neatly** burnished on both sides to remove the finishes and expose bare metal for a positive electrical connection.
- V. Mechanical ground connections to trays, ladders, frames, chassis, enclosures, conduits, etc. shall be made using dedicated grounding hardware to the main equipment structure. Multi-purpose use of equipment structure hardware or attachment to equipment accessories or sub-structures (e.g. gussets, brackets, hangers, mounting brackets, etc.) is not acceptable.
- W. All grounding and bonding conductors shall be insulated stranded copper, colored green or clearly marked with green tape, minimum conductor size #6 AWG. Bare copper conductor should only be utilized when exposed in plenum rated areas or buried below grade.
- X. Where required by local code interpretation, the communications grounding system backbone and bonding conductors shall be bare stranded copper conductor in lieu of an insulated conductor when installed in open cable trays, and/or exposed in a return air plenum space or riser rated space, Contractor to verify requirements and coordinate with the Engineer.
- Y. Where indicated on the Engineering Drawings, an equipment ground bar shall be mounted on the rear side of the indicated 19" equipment racks, at the top of the rack, unless noted otherwise. All active equipment (e.g. switches, routers, etc.) and shielded cable grounding towers or frames, etc. on the indicated rack shall be bonded to the rack ground bar. In turn, the rack ground bar shall be bonded with a #6 ground to the TGB/TMGB. The equipment rack ground bar kit shall be a Harger #RGBHKIT14119.25B14 or Engineer approved equal.

- Z. All grounding and bonding conductors shall be maintained as short and straight as possible, with the maximum radius bends practical (20x conductor dia.), in no case should the minimum bend radius be less than 10x the conductor diameter. Daisy chaining of grounding and bonding conductors shall be minimized.
- AA. All grounding and bonding conductors shall be free from loops and coils (either partial or full), no bends should be greater than 90°.
- AB. All grounding and bonding conductors shall be protected from physical damage, the conductor shall not be run exposed across the floor or strung from item to item without intermediate support. Route grounding and bonding conductors to provide physical protection and support or route in conduit as required.
- AC. Grounding and bonding conductors shall be provided to all items and equipment elements in lieu of the unreliable physical mounting means for electrical continuity. The utilization of conduit fittings, mounting hardware, support hardware or the attachment hardware for providing grounding and bonding in lieu of a grounding and bonding conductor is not acceptable.
- AD. A grounding bushing shall be utilized on each unbonded conduit to bond the conduit to ground, discard the setscrew type clamp provided and bolt the compression type ground lug directly to the bushing using a stainless steel machine screw and star washer.
- AE. Grounding bushings shall be utilized on each conduit which is not bonded to a grounded enclosure by means of properly installed conduit nuts, one on each side of the enclosure panel and properly tightened such as to cut through the panel paint and make bare metal to metal contact.
- AF. Where a grounding bushing has not been installed on a conduit and cannot be installed due to the installed cable base, a U.L. listed, bonding and grounding wedge shall be installed on the end of the conduit adjacent to the existing bushing fitting. Attach the compression type ground lug to the bonding and grounding wedge using a stainless steel machine screw and star washer.
- AG. Two (2) hole compression lugs only shall be utilized on the grounding system backbone cables where attached to the grounding system distribution bus bars, and the electrical service entrance equipment (MDP) ground bus bar (usually a #2 AWG or greater conductor).
- AH. Two (2) hole lugs shall also be utilized when attaching an external building ground grid to the Telecommunications (Main) Grounding Bus bar (TMGB/TGB).
- AJ. The communications grounding system shall be extended to and through communications raceways such as cable trays, cable channels, ladder systems, metallic surface mounted raceways, etc. for raceways not U.L. listed and/or

installed as "classified as suitable as an equipment grounding conductor". The grounding system may be extended by means of extending a #6 AWG minimum bonding conductor through the length of the raceway system and lugging to each section of raceway, lugging at 10 foot maximum intervals along the length of the raceway, and lugging to any section of raceway greater than three feet in length in lieu of the installation of individual bonding jumpers between each raceway section.

- AK. Where a bare copper Telecommunications Bonding Backbone (TBB) conductor or bonding conductor is routed through a cable tray system, the conductor shall be tied down and anchored to the cable tray, 36" max. on center, utilizing a split bolt or equal as required, with the nut on the exterior of the tray.
- AL. Extend bonding jumpers to all pull boxes and/or transition fittings along the raceway system. The bonding conductor shall be extended through conduit or conduits connecting sections of cable tray, channel, ladder or metallic raceway systems.
- AM. Unless otherwise noted, individual continuous "zone" conduits shall be bonded to ground at the "home" end, with a bonding jumper installed to and through all pull boxes. Bond at the "zone" end to building steel as available.
- AN. Exposed grounding and bonding conductors entering cabinets and enclosures shall be provided with a rubber grommet or chase nipple and bushing. Install grommets or bushings as required.
- AO. Wherever possible, a two-hole compression lug shall be bolted down using two (2) bolts. When the two-hole compression lug can only utilize one-hole, always utilize the hole nearest the compression fitting, cut-off excessive tang length.
- AP. The communications grounding system shall meet NEC Article 250 & 800 requirements. Contractor shall bond individual electronic components and equipment to the grounding system as per the equipment manufacturer's recommendations and instructions.
- AQ. The Contractor shall inspect and verify all the existing grounding systems to which attachments are being made, which shall include but not be limited to the following:
 - 1. Electrical Service Entrance Grounding
 - 2. Telephone Service Entrance Grounding
 - 3. Electrical System(s) Grounding
 - 4. Structural Building Steel Grounding
 - 5. Conduit and Raceway System(s) Grounding
 - 6. Natural Gas Line Grounding
 - 7. Ground Connection to the Source Side of Water Meter and the Water

Meter Bonding Jumper

- AR. Existing grounding systems shall be checked for requiring to be cleaned, re-tightened and/or re-made with a suitable anti-oxidant applied, as required to bring them up to code and standards. Discrepancies in existing systems shall be brought to the attention of the Engineer in writing, for additional corrective action as required.
- AS. The Contractor shall include a written report with the system grounding Test Form #1. The written report shall detail the inspection, service required or performed and verification procedures of the existing grounding systems performed by the Contractor and shall detail the findings and any actions taken (e.g. existing #4 ground conductor from main tel-brd and ground clamp removed from service side of water meter, all connections cleaned and burnished, anti-oxidant applied, reassembled and tightened).
- AT. Items to be bonded to the communications grounding system at the ground distribution bus bars shall include, but not be limited to the following:
1. Telephone equipment (e.g. PBX's, KSU's, CSU/DSU, etc.)
 2. Existing telecom grounding busbars/systems
 3. Equipment racks and cabinets
 4. Cable ladders, trays and channels
 5. Surface mounted metallic raceways and wireways
 6. Metallic conduit systems
 7. Service entrance protected terminals
 8. Telecommunications and fiber optic splice enclosures
 9. Interbuilding cable sheaths and messengers
 10. Coupled bonding conductors
- AU. The positioning of ground terminators on the communications ground bus bar shall be specific to the grounding function. Starting at one end of the ground bar, terminate across the ground bar as follows:
1. The first group on the starting end should be the branch circuit non-isolated equipment grounds.
 2. All fault current dissipation paths are to be grouped next (e.g. panel grounds, feeder circuit grounds, etc.).
 3. All transient sources are to be grouped next.
 4. The main grounding backbone (TBB) conductors are to be terminated in the middle.
 5. All isolated equipment grounds are to be grouped next.
 6. All signal reference grounds are to be grouped at the finishing end (e.g. dedicated grounds to cable shield grounding towers, dedicated grounds to equipment ground lugs isolated from the power cord ground pin, etc.).

3.02 SYSTEM TESTING

- A. Upon completion of the installation of the communications grounding system and/or servicing of the existing grounding systems, the Contractor shall perform approved standard ground resistance tests with an Engineer approved ground resistance test unit (i.e. stakeless clamp-on ground resistance tester, two-point and three-point fall of potential tester), using approved procedures as noted in this specification.
- B. **CAUTION:** Never assume a ground wire is electrically dead without first testing to be sure. Always test for and record, the ground current in the ground conductor at the test point prior to measuring ground resistance. Erroneous ground resistance measurements will result if the ground current exceeds 2 amps AC. Contractor shall identify sources of high ground current (greater than 2 amps AC) before proceeding with ground testing.
- C. **NOTE:** By measuring at several points and comparing the readings, (for both ground current and resistance) it is possible to identify neutral/ground loops, utility grounds and central office grounds. The tests are effective and accurate because the ground window is connected to the utility ground at only one point, according to standard practices and code. A reading of less than 0.1 ohm generally indicates that the cable is continuous with itself, providing an acceptable ground path, which can be usually confirmed by comparatively nominal to high ground current readings. The source of a ground current may be obtained when readings are taken at multiple locations around the loop. An acceptable low resistance ground may have a high AC ground current flow, depending upon the type of equipment being grounded.
- D. The Contractor shall inspect, service, and verify all of the grounding systems as per this specification section. Failures of the existing grounding systems to meet the intent of this section shall be brought to the attention of the Engineer and Owner in writing.
- E. The Contractor shall perform Telecommunication Grounding System Testing as follows:
 - 1. Measure ground current and ground resistance readings on all Telecommunications Bonding Backbone (TBB) conductors at each TMGB/TGB.
 - 2. Measure ground current and ground resistance readings on all bonding jumpers at each TMGB/TGB.
 - 3. Record all readings on Test Form #1. Contractor to reproduce Test Form #1 as required.
 - 4. Where test results indicate a ground current of 1 amp or greater, the Contractor shall take appropriate action to identify and reduce the ground

current to less than 1 amp. The Contractor shall notify the Engineer in writing of the excessive ground current, the source and action taken to reduce the current.

- F. The Contractor shall demonstrate by testing that the communications grounding system to earth resistance value is 10 ohms or less, utilizing a clamp-on or 3 point fall of potential tester.
- G. The Contractor shall be able to demonstrate by test that the data/telecommunication grounding system resistance from any grounded non-current carry conductor in the system to the electrical service entrance neutral/ground bonding conductor is less than 0.1 ohm.
- H. The Contractor shall record the test results on Test Report Form 1 included herein, and provide a description of the testing procedures for submission to the Engineer for approval.
- I. Contractor shall include copies of the completed and approved test report in the cabling system instruction manuals.

END OF SECTION 27 0526

SECTION 27 0528 – COMMUNICATIONS RACEWAY SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Division 27 General Provisions and Basic Materials and Methods sections apply to work specified in this section.

1.02 DESCRIPTION OF WORK:

- A. Provide a complete structured raceway system including all boxes, backboards, outlet boxes, conduit, cable trays, j-hooks, fittings, sleeves, etc., for the communications systems as shown on the drawings, specified or required.

1.03 QUALITY ASSURANCE:

- A. NEC Compliance: Comply with NEC as applicable to communications system materials and installations.
- B. NEMA Compliance: Comply with applicable portions of NEMA standards pertaining to types of electrical equipment enclosures.
- C. TIA 569B Compliance: Comply with TIA-569B standards for telecommunications pathways and spaces for commercial buildings.
- D. The installation of the communications raceway systems shall be performed under the direction and supervision of the Contractor's designated Project Registered Communications Distribution Designer (RCDD) under Specification Section 27 1500.
- E. The Contractor's designated project Registered Communication Distribution Designer (RCDD) shall be responsible for verifying the routing and sizing of cable tray, channels, wireways, conduits, etc. as required to meet the intent of the Specifications. Where applicable, the Contractor shall submit for the Engineer's review and acceptance, drawings indicating raceway routing, size, cable fills, etc.

PART 2 - PRODUCTS AND EQUIPMENT

2.01 BACKBOARDS:

- A. Provide in the areas or rooms as indicated on the detailed engineering drawings and documents, for mounting electrical, electronic, communications equipment, A/C PLUGGED-INT-APA void-free plywood sheets 48"W x 96"H x 3/4"THK in size, painted with two (2) coatings of fire retardant paint; Flame Control No. 20-

20 as available from Glidden, Benjamin Moore, Pittsburg Paint and Sherwin Williams. Unless noted otherwise, plywood sheets shall be installed flush on the finished drywall, block or concrete wall, securely anchored to the building structure, and extending 4" or less from the floor or curb up the wall 8'-0". All communications cable conduits shall stub onto either the backboards or onto cable trays and ladder systems.

2.02 CABLE LADDER:

- A. Cable ladder shall be B-Line/Saunders Type SB aluminum cable runway with removable/relocated rungs, in standard bare aluminum finish unless otherwise noted, as indicated on the drawings. The ladder shall be installed per manufacturer's instructions, utilizing manufacturer's accessories and components.

2.03 CONDUITS:

- A. Conduits shall be installed per Raceway Specification Section 26 0533 of this specification except as noted. The sizes of conduits shall be as shown on the drawings, minimum size is 1". All conduits shall be reamed and furnished with insulation and/or grounded bushings as required.
- B. Flexible steel conduits shall not be utilized for communications raceway systems without specific written approval of the Engineer for the application.

PART 3 - EXECUTION

3.01 CONDUIT:

- A. Conduits shall be sized as per Table I herein or as noted on the drawings. Where sections of conduit runs are longer than 100'-0", or have more than 180° of bends, or have a reverse (greater than 90°) bend, pull boxes shall be provided and installed. Bends in conduits larger than 2", shall be long sweep bends. Unless otherwise noted, in no instance shall the inside radius of bends be less than:
 - 1. Six times the internal diameter for conduits 2" and smaller.
 - 2. Ten times the internal diameter for conduits 2-1/2" and larger.
- B. Conduits entering Telecom Rooms (TRs) shall terminate as close as possible to the wall through which the conduits enter, unless otherwise noted. In-floor conduits shall terminate 4" A.F.F. or curb unless noted otherwise. All conduits shall be left clean, dry and free of debris or other obstructions, with insulated grounding bushings installed.
- C. Pull boxes shall be constructed of code gauge steel, etched, primed and shall

have rust resistant ANSI 61 gray finish and be NEMA 1 construction with screw covers unless noted otherwise. For conduits 1-1/4" and larger terminating in a pull box, the minimum length of pull box shall be 8 times the diameter of the largest conduit terminating in the pull box. Splice boxes shall be sized as per TIA-569B Table 5.2-3. Pull boxes and/or splice boxes shall be placed in straight sections of conduit runs and should not be used in lieu of a bend without approval of the Engineer. Pull boxes and/or splice boxes shall be installed in readily accessible locations. Where boxes are installed above suspended ceilings, they shall be located immediately above the suspended ceiling or the ceiling shall have a suitably marked and hinged panel or equivalent to facilitate direct access to the box. Location and sizes of pull boxes and splice boxes shall meet the approval of the Engineer. Condulete type fittings shall not be used in lieu of pull boxes or bends.

- D. Conduit, sleeves and stubs through fire rated floors and walls shall be rigid galvanized steel conduit with insulated and/or grounding bushings as per specifications, sized as per the schedule herein. Conduit sleeves shall be a minimum 12" long. Install fire stop as per specifications and codes upon completion of the work.
- E. Provide pipe sleeves as shown on the drawings. The sleeves shall extend 4" above the floor and a minimum of 2" below the bottom of ceiling slab. The inner edges of the sleeve at both ends shall be reamed, providing a smooth surface to prevent damage to cable insulation. Sleeves shall be equipped with metal caps to ensure fireproofing between floors and/or insulated bushings (when occupied). Sleeves shall be installed plumb and shall be vertically aligned to provide a clear vertical pull of cable without offsets. The number, size and location of sleeves shall be as shown on the drawings.

3.02 MISCELLANEOUS:

- A. Raceway systems shall be bonded to the communications grounding system, as per NEC Article 250, TIA 607 standard and Specification 27 0526.
- B. Provide and install a minimum of two duplex receptacles rated 20 amp 110 volt on a dedicated circuit, on the telephone backboard, to be located as directed, 72" M.H. unless noted otherwise. Full area of the backboard shall be kept free of all pipes or conduits with a minimum of 36" depth of maintenance area in front.
- C. Provide a 1/8" nylon or polypropylene line in all conduits.
- D. The Contractor shall contact the service provider(s) before proceeding and shall coordinate his work with theirs.
- E. **The Contractor shall submit for Engineer review and acceptance, drawings**

indicating cable tray, conduit or other raceway routing, size, cable fill, etc. as required to verify that the installation will meet all aspects of the Specification.

- F. The Contractor shall verify with the Architect or the local building authority, the fire rating requirements of any wall or floor to be breached by a conduit, cable, raceway or other penetration as per ASTM E-119 (NFPA-251 and UL-263) standards. The Contractor shall notify the Engineer and Owner in writing of all existing non-compliant conditions for resolution.
- G. The presence of existing non-compliant conditions will not exempt the Contractor from meeting the installation fire rating requirements for new work.
- H. The Contractor shall provide through penetration firestopping as per ASTM E-814 and UL-1479. Firestop systems shall have been tested by UL and meet the rating criteria, as published in the UL Fire Resistance Directory. The Contractor is referenced to the latest BICSI Telecommunications Distribution Methods Manual (TDMM) and TIA-569B Annex "A" for general guidelines and overview of firestop technology and methods. Contractor shall consult individual manufacturers instructions for specific application details.
- I. Openings around cable trays, cable channels, conduits or in sleeves penetrating fire-rated floor slabs, walls, partitions, ceilings or smoke partitions, shall be sealed at both sides of the partition. Pack openings with calcium silicate blocks, 3M Brand Fire Barrier Caulk CP25 and Putty 303, 3M Brand Series 7902/7904 systems for floor and walls, Nelson Flame Seal System, or an Engineer accepted material having the same fire-rating as the floor or wall penetrated. Fiberglass is not acceptable.
- J. Where indicated on the drawings and/or at the Contractor's discretion, the Contractor may utilize the Specified Technologies, Inc. EZ-Path fire rated pathway assemblies to facilitate future moves, adds, and changes (MACs).
- K. All firestopping systems shall be of a single manufacturer, as manufactured by 3M, Nelson, Specified Technologies, Hilti or Engineer approved equal. Contractor shall submit cut sheets with Authority Having Jurisdiction (AHJ) approval to the Engineer for review and acceptance.

END OF SECTION 27 0528

SECTION 27 1300 - INTERBUILDING COMMUNICATION CABLE SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Division-27 General Provisions and Basic Materials and Methods sections apply to work specified in this section.
- B. Other applicable portions of the specifications are part of this section as if written in full herein, shall include, but not be limited to the following:

1.02 SCOPE OF WORK:

- A. Extent of the interbuilding communication cable system is indicated on the drawings, schedules and contract documents.
- B. Types of interbuilding communication cable systems specified in this section include the following:
 - 1. Telephone/Voice Communication Cable Systems
 - 2. Fiber Optic Cable Systems
- C. Furnish and install conduit, ductbanks, cable trays, cable, splice enclosures, lightning protection equipment, grounding systems, distribution blocks, distribution frames, network interface equipment, etc. as indicated on the drawings, schedules and the contract documents.
- D. The Contractor shall bid the project as specified and shown on the drawings and documents. The drawings illustrate the work specified and are intended to agree in every respect with one another and with the specifications. Any discrepancies shall be brought to the attention of the Engineer for correction. No omission from any drawing shall release the Contractor from furnishing equipment, materials or services called for by the specifications or other drawings.
- E. Any deviation, alteration, or substitution from the drawings and specifications shall be fully documented by the Contractor and submitted as a voluntary alternate to the base bid with the amount of deduct to the base bid specified. Approval of requests for substitution of products, processes, or procedures other than those specified will be contingent upon submission of fully acceptable documentation to the Engineer and shall be the sole decision of the Engineer.

- F. All equipment furnished shall be new and of the quality specified in the specification. No equipment may be furnished that has ever been in use either in the present installation or in another installation except as noted in the project specification or the drawings.
- G. Products that are submitted for substitution must be electronically, electrically and mechanically interchangeable with the specified product. Substitutions will only be allowed with written approval by the Engineer. Samples of proposed substitutions must be submitted prior to approval at the discretion of the Engineer. Any substitutions without the written approval of the Engineer are done so at the risk of the Contractor. Substitutions unacceptable to the Engineer will be rejected without explanation or appeal and replaced at the Contractor's expense.
- H. The Contractor shall clean and organize his work areas daily. He shall be responsible for maintaining cleanliness in all work areas so as to not adversely affect other trades, Contractors, vendors, suppliers, or the Owner in the timely installation of equipment and/or implementation and completion of concurrent responsibilities.
- I. The Contractor shall be responsible for protecting any and all equipment and materials from damage during his installation process. Any equipment, material and/or facilities damaged by the Contractor during, or due to, or in the performance of his contract, shall be replaced or repaired at the expense of the Contractor as directed by the Engineer.
- J. All drawings, specifications and other contract documents and the Owner's proprietary information shall be returned to the Owner/Engineer upon satisfactory completion of the contractual.

1.03 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in the manufacture of communication cabling system components of the types specified herein and on the drawings and whose products have been satisfactorily used in similar applications for not less than five years.
- B. Communications Contractor: Shall be fully capable and experienced in the information transport systems specified. This contractor and/or all sub-contractors engaged in this Communications Installation shall have experience in the business of Communications Systems installations of not less than five (5) years and shall have successfully completed a minimum of five (5) projects of similar size and complexity. They shall be fully capable and experienced in the information transport systems specified and shall provide at minimum five (5) reference accounts at which similar work (both in scope and design) has been

successfully completed by the Contractor and his sub-contractor(s) within the last five (5) years. Client reference information shall include but not be limited to the following items:

1. Client Company Name and Address
 2. Contact Name, Title and Telephone Number
 3. Installation Start-up, Completion & Acceptance Dates
 4. Brief Description of Project
- C. Failure to provide client reference accounts and project information may eliminate the bid from consideration.
- D. The Contractor shall specify all sub-contractors who will be utilized in the project. The bid will include:
1. Sub-Contractor Name, Address and Contact Information
 2. Sub-Contractor Responsibilities and Scope of Work
 3. Supportive Documentation Verifying Sub-Contractor Qualifications
- E. The Engineer may, with full cooperation of the Contractor, visit reference installations to observe equipment installation, operations and consult with references. Specified visits shall be arranged by the Contractor. However, the Contractor may not be present during discussions with references.
- F. The Contractor shall have a Registered Communications Distribution Designer (RCDD) on staff who will ultimately be responsible to the Engineer and/or Owner for all work performed by the Contractor and/or his sub-contractors under this Specification and associated communication documents.
1. The RCDD shall have the authority of the Contractor to make immediate decisions regarding implementation of changes to the project as directed by the Engineer.
 2. The RCDD shall have sufficient experience in this type of project to be able to answer questions of field forces during installation and anticipate problems and ensure the smooth and timely transition to the new Communications System being installed.
 3. The RCDD's resume shall be attached to the Contractor's bid.
 4. Should the RCDD change or be re-assigned during the project, the new RCDD shall follow the same procedure of review and acceptance by the Engineer and Owner.
 5. Part-time, Contract RCDD employees are not acceptable. The Contractor's RCDD shall be a full time employee of the Contractor.
- G. If in the opinion of the Engineer and Owner the RCDD does not possess or demonstrate adequate qualifications to support the project, the

Owner reserves the right to require the Contractor to assign a RCDD who, in the Engineer's and/or Owner's opinion, possesses the skill necessary to complete the project.

- H. Acceptability of qualifications of the RCDD shall be made solely by the Engineer and Owner and shall be based upon but not limited to the following:
1. Demonstrates a thorough knowledge and understanding of TIA standards 568-C, 569B, 570A, 606A, 607B, 758, the latest edition of the BICSI Telecommunications Distribution Methods Manual (TDMM) and the latest edition of the BICSI Outside Plant Design Reference Manual.
 2. Information provided by and the recommendations of Reference Accounts.
 3. A demonstrated history for the timely submittal of shop drawings, test equipment descriptions, test procedures, test set-up parameters and calibrations, reports, schedules, etc.
 4. Demonstrated ability for the maintenance of project documents, records, drawings, schedules, progress reports, as-builts, etc. on the construction project in a current and up-to-date condition and available for inspection.
 5. Demonstrated ability and willingness to coordinate, communicate and cooperate with other contractors, vendors, trades, the Engineer, Owner, and others.
 6. Demonstrated ability to properly supervise, oversee and manage the project and installation crew so as to ensure compliance with Engineering Documents and Industry Standards.
 7. A demonstrated and verifiable commitment to a continuing and on-going educational program designed and intended to maintain the RCDD's knowledge and expertise consistent with the latest industry standards and developments (such as BICSI educational programs and other relevant seminars, etc.)

1.04 STANDARDS COMPLIANCE:

- A. NEC Compliance: Comply with NEC Article 800, National, State and Local codes as applicable to wiring methods, construction and installation of interbuilding communication cabling systems. Comply with NEC Article 770, National, State and Local codes as applicable to the installation of interbuilding fiber optic cable systems.
- B. NFPA Compliance: Comply with NFPA, National, State and Local codes as applicable to wiring methods, construction and installation of interbuilding communication cabling systems.
- C. NEMA Compliance: Comply with applicable portions of NEMA-250 standards (et al.) pertaining to electrical and/or communication equipment and enclosures.

- D. TIA Compliance: Comply with TIA 568-C, 569B, 606A, 607B, 758, National, State and Local standards for commercial building wiring for interbuilding voice and communications as applicable.
- E. IEEE, ANSI and ISO Compliance: Comply with interbuilding communication cabling system standards of IEEE, ANSI and ISO as applicable.
- F. REA, Bell Core Compliance: Metallic telecommunication cable and fiber optic communication cable and accessory components shall comply with REA, Bell Core standards and specifications as applicable.
- G. UL Compliance: All components shall comply with UL1863 standards (et al.) and be UL listed and labeled as applicable.
- H. Drawings, specifications and other contract documents are intended to comply with or exceed industry standards and code requirements. The Contractor shall notify the Engineer in writing of any discrepancies or conflicts for resolution. In the absence of a written Engineer accepted resolution, the more stringent criteria shall apply.

1.05 INSPECTION OF WORK/CONSTRUCTION AREA:

- A. Authorized representatives of the Owner and Engineer shall have access to the construction site at any reasonable time to inspect equipment, material, the installation and to obtain information on work quality, progress and delivery.

1.06 ON-SITE PROJECT MANAGER (OR PROJECT FOREMAN):

- A. The on-site Project Manager will be responsible to the RCDD and Engineer, and Owner for all aspects of project quality of installation and compliance with standards, specifications and the Engineering drawings. The Project Manager shall have an office in a designated area, as approved by the Engineer and Owner at the project site and shall be on-site whenever work is being performed and installation crews are present.
- B. The Project Manager shall be Engineer and Owner approved and shall be a BICSI registered cabling installation technician, a NJATC certified installer/technician journeyman, a BICSI RCDD or Engineer approved equal.
- C. The Project Manager shall maintain and update all job-related documentation including but not limited to record drawings, specifications, addendums, and bulletins. He shall keep a master copy of project schedules and as-builts in his office at all times, available for inspection.
- D. All workmanship by the Contractor shall be of the highest quality. All tradesmen and technicians performing work under this specification and associated

communication specifications shall be enrolled in and/or have completed the NJATC Installer/Technician Apprenticeship Program, be a BISCO Registered installation cabling apprentice/installer/technician, or an Engineer approved equal. All apprentices or tradesmen with two (2) years or less experience after completion of an approved training program shall work under the direct supervision of a Registered Installation Cabling Installer or a tradesman with a minimum of two (2) years of Engineer approved experience after completion of an approved training program.

- E. The Contractor shall maintain on the jobsite, current updated copies of all specifications, addenda, bulletins, drawings and other pertinent contract documents. These documents shall be readily and conveniently available to the tradesman and technicians for reference.
- F. The Contractor's Project RCDD shall immediately notify the Engineer of any existing or developing conditions which may adversely affect the quality and/or performance of the installation. Notification of the Engineer shall be made in a timely manner, as to minimize or eliminate changes and rework.
 - 1. Notification may be by either voice (phone) or e-mail. Voice notification shall be followed up by an e-mail confirmation.

1.07 EQUIPMENT WARRANTIES:

- A. The Contractor shall warranty installation to be free from inherent defects in design, workmanship and material. The installation shall function properly and continually under all required operating conditions, specified or reasonably implied in the contract documents. The Contractor shall replace, at no expense to the Owner, the equipment and/or materials, or any component thereof, found defective, upon delivery or within two (2) years from date of final inspection and written acceptance by the Owner and/or Engineer.

1.08 SPECIAL CONDITIONS:

- A. Computer and voice systems may be required to be taken off-line or removed from service during this contract. Specific instructions may be found in the Detailed Project Specification and Schedule accompanying this document.
- B. The computer, telephone and other systems associated with this work will not be taken off-line or removed from service during normal working hours.
 - 1. These systems are critical to the provision of services to the Owner's clients and shall not be interrupted by the Contractor's activities. Arrangements must be made by the Contractor to coordinate any such activities.

2. The Contractor shall be required to work around the above conditions, as well as work with the Owner's staff to minimize disruptions to normal Owner activities.
- C. The Contractor shall provide timely written notice of the need to disconnect any existing voice, computer or other system to the Owner and copy the Engineer.
1. The Owner, Engineer, and Contractor shall schedule such outages as required, directed or as stipulated elsewhere in the project specifications, appendices, or schedules.
 2. System outages shall be performed only with the authorized consent of the Owner and Engineer.
 3. The Contractor shall perform no testing, outages, modifications, or other functions on active operating systems without prior approval of the Owner and Engineer.
 4. The Contractor will be responsible for any damages, expenses incurred, or losses suffered by the Owner or others caused by his unauthorized actions.

PART 2 - PRODUCTS

2.01 GENERAL:

- A. Design and workmanship shall be in accordance with the requirements of the contract documents and subject to acceptance by the Engineer. Components shall be of the latest type and design, manufactured for the intended use, and shall be laid out and installed so as to afford easy maintenance and/or replacement without major disassembly of adjacent components.
- B. All products shall be bid as specified. Any deviation from the products specified shall be noted in the bid and listed as a voluntary alternate to the base bid with price deducts listed. All substitutions require ten (10) days for evaluation for prior approval by the Engineer. Products substituted must be demonstrated to the Engineer to be electrically and mechanically interchangeable with the specified product. Samples of the substituted product may be requested from the Contractor to validate claims that the substituted product will meet the electrical and mechanical constraints of the specified product.
- C. Eight (8) sets of shop drawings shall be submitted in a timely manner for all specified equipment and substituted equipment to the Engineer for approval prior to purchase, installation, or fabrication. Shop drawing submittals shall indicate full complete compliance with all Specifications herein. Shop drawings not indicating full compliance will be returned unapproved for resubmittal. Non-approved materials and equipment shall be immediately removed and replaced at the Contractor's expense.

2.02 CABLES:

Unless specified otherwise on the drawings or in contract documents, interbuilding communication cables shall be as specified herein. Cables are to be categorized as follows:

A. 100 Ohm Multi-Twisted Pair Voice Grade Cables:

1. Available in multi-pair counts from 6 to 3,600 pairs. Pairs are to be color coded using solid wire color with tracer color and utilize the insulation color code standard. Conductors shall be 24 AWG solid copper twisted pairs. The cable shall be rated as for the application-aerial, direct buried or underground (ductbank or tunnel), as per REA or Bell Core standard designations. Cable to be further classified as to "filled core" or "air core" construction and "gopher resistant".
2. Interbuilding cable construction shall generally consist of the cable core wrapped with a non-hygroscopic tape and enclosed in a metallic cable sheath and jacket.
3. Cable shall be suitable for voice and carrier frequency use, both analog and digital at performance Category-3 (≤ 16 MHz), on a selected pair assignment basis. Cables greater than 100 pair shall be performance rated as reduced Category-3 (≤ 10 MHz).
4. "Filled" cable construction to be specified for aerial and ductbank installations. "Air core" cable construction to be specified for tunnel installations only. "Gopher resistant-filled" cable construction to be specified for direct buried applications.
5. Interbuilding cable to be:
 - a. AT&T type "BKMA" for tunnel installation only.
 - b. RUS PE-39 (Sealpic-F) for concrete encased duct bank installation.
 - c. AT&T type "ANMW" for direct buried, directional bored PVC/PE conduit, buried conduit installation.
 - d. As otherwise noted or Engineer approved equal.

B. Optical Fiber Cable – Outdoor Interbuilding Backbone:

1. Optical fiber cable shall be utilized for interbuilding runs as specified on the drawings and project specifications. Interbuilding backbone cables typically run from entrance facility to entrance facility. Cable shall be new, unused and of current design and manufacture. Fiber optic cable

shall be manufactured in an ISO 9001 certified manufacturing facility.

2. Cable Construction:

- a. Cable construction shall be Indoor/Outdoor, 250 um buffered, loose tube, OFNR rated.
- b. Loose tube construction shall be by stranding color coded buffer tubes around a central member using reverse oscillated lay. The core is wrapped with flexible strength members and covered by water blocking tape and encased in a black jacket with rip cords.
- c. Jacket construction shall be armored.
- d. Printed on the outer jacket shall be the manufacturer's identification and required UL markings. Included on the manufacturer's identification shall be the date of manufacture, part number, and descending sequential foot markings. Length marks shall have tolerance ratings of -0% to +1% actual length measurements.
- e. Cable construction and performance shall be Telcordia GR-20-Core, Telcordia GR-409, TIA-472, TIA-492, IEC 60793, ANSI/ICEA S-87-640, Bell-Core TR-TSY-000020.

3. Fiber Type and Performance:

- a. Fiber type shall be 50/125 um multi-mode, loose tube.
- b. All fiber shall be minimal proof tested to 0.7 CPA (100 kpsi).
- c. 50/125 Multi-Mode Core Dimensions:

Core Diameter	50.0 um \pm 2.5 um
Cladding Diameter	125.0 um \pm 1.5 um
Core to Cladding Offset	\leq 1.5 um
Cladding Non-Circularity	\leq 1.5%
Numerical Aperture	0.200 \pm 0.015

d. Environmental Range:

Operating Temperature	-40°C to +85°C
Storage Temperature	-55°C to +85°C
Humidity	5% to 95%

e. Minimum Bend Radius:

Under Tensile Load – Not less than 20 times outside diameter
Under No Load – Not less than 10 times outside diameter

f. 50/125 um Multi-Mode Optical Characteristics:

	<u>Loose Tube</u>	<u>Tight Buffered</u>
850 nm Attenuation	≤ 3.5 dB/Km	≤ 3.5 dB/Km
1300 nm Attenuation	≤ 1.5 dB/Km	≤ 1.5 dB/Km
850 nm Bandwidth	≥ 2000	
1300 nm Bandwidth	≥ 500	

1 Gbps Ethernet @ 850 nm	\geq	1000 meters
1 Gbps Ethernet @ 1300 nm	\geq	600 meters
10 Gbps Ethernet @ 850 nm	\geq	300 meters
10 Gbps Ethernet @ 1300 nm	\geq	300 meters

g. Optical fiber shall be manufactured by OFS, Corning Glass or Engineer approved equal. All shop drawing submittals shall indicate the supplier and manufacturer of the optical fiber.

h. Outer Jacket Color:

OSP Cable	- Black
Indoor/Outdoor	- Black
Premise 62.5/125 um Multi-Mode	- Orange
Premise 50/125 um Multi-Mode	- Aqua
Premise 8.3/125 um Single-Mode	- Yellow

i. Standard Fiber Color Code:

1 – Blue	5 – Slate	9 – Yellow
2 – Orange	6 – White	10 – Violet
3 – Green	7 – Red	11 – Rose
4 – Brown	8 – Black	12 – Aqua

For fibers 13 and higher, the color code is repeated, with a black stripe and/or dash added.

j. Optical fiber characteristics shall be as measured per TIA-455-46, 51, 53, 61, 78, 168 and 175 procedures.

k. Outdoor duct/aerial cable to be engineered to separate as many environmental conditions from the fiber as possible. UV inhibitors to be embedded in the outer jacket for protection against the sunlight. Cable to utilize a loose tube design to remove any tension or pulling forces from the fibers. Proper slack of fiber

within the buffer tube allows the cable to sag during temperature cycles in aerial installations. All duct/aerial cables are to be loose tube dry water blocked and all-dielectric.

- l. Armored cables are to be suitable for direct buried installations either by being placed in an open trench or by plowing. These cables to feature rodent protection, a corrugated tape between the UV resistant outer and inner jackets and a loose tube design to prevent damage to the fibers even during rigorous installation and external impacts. All armored cables are to be loose tube and dry water blocked.
- m. Tight buffered, dry water blocked, multi-mode cables are suitable for duct/aerial cable installations only. Tight buffered, dry water blocked, single-mode cables shall be utilized only for dry duct and tunnel installations where the higher attenuation is acceptable to the Engineer. Verify your loss budget.
- n. Cable shall be as specified on the Engineering Documents or Engineer approved equal. Contractor shall verify that the cable to be provided meets all specifications.

2.03 HARDWARE:

Unless specified otherwise on the drawings or in the contract documents, interbuilding communication cabling system hardware shall be as specified herein. Hardware is generally categorized by the transmission media as follows:

A. 100 Ohm Multi-Pair U.T.P. Cable System Hardware:

1. Splice Enclosure:

- a. Splice enclosures are to be used to encase and protect cable splices from a wide variety of environmental conditions, and are classified for aerial, underground, buried or building application. Splice enclosures shall be determined by the application, type and size of cable, pair count and splice connectors. All splice enclosures shall be of the re-enterable type, direct buried splice enclosures shall be encapsulated. Splice enclosure shall be as manufactured by Tyco/Raychem, 3M, Preformed Line Products (PLP) or Engineer approved equal.
- b. Splice connectors shall be of the modular (Systimax No. 710) or single (Systimax No. 709) type design, compatible with the splice enclosure as required and shall be as manufactured by Systimax, 3M, AMP or Engineer accepted equal. Splices shall be made using only the manufacturer's recommended crimping tools.
- c. A sheath, bonding and grounding jumper shall be installed across each splice enclosure, as required to assure grounding continuity of the sheath and enclosure. The bonding and grounding jumper

shall be compatible with and as manufactured by the enclosure manufacturer or as manufacturer recommended.

- d. All abandoned or dead ended pairs shall be grounded in the splice enclosure using an approved bonding bus bar.

2. Building Entrance Protection:

- a. Building entrance protection equipment shall be of the indoor type, sized as required for the incoming pair count. All incoming conductor pairs shall be landed on entrance protection equipment. Building entrance protection equipment shall be Systimax No. 489 for digital voice and data carrier frequency applications. Systimax No. 489 equipment shall terminate on 110 wiring blocks. Plug-in protector module units are provided separately.
- b. All telephone pairs are to be terminated on entrance protectors.
- c. Plug-in protector modules are available with gas tube or solid state overvoltage protection. Type 3 modules offer overvoltage protection only, Type 4 modules have heat coils for sneak circuit protection. Plug-in protector modules as manufactured by Systimax are:
 - 1) Type 3B1-EW: Gas tube protector, general purpose, voltage protection only; digital phone and "data user drop" use only.
 - 2) Type 4B1-EW: Gas tube protector with 4 OHMS heater coils, voltage and sneak current protection; analog/digital phone system side and "data user side" use.
 - 3) Type 3C1S: Balanced solid state protector with test access, voltage protection only, as required by equipment vendor.
 - 4) Type 4C1S: Balanced solid state protector with 4 OHMS heater coils and test access, voltage and sneak current protection, as required by equipment vendor.
 - 5) Type 4C3S-75V: Balanced solid state protector with 4 OHMS heater coils, voltage and sneak current protection; color red, for special purpose non-ringing circuits.
 - 6) Type 3B1D: Line grounding protector to be used for all unused non-working circuits at both ends.

B. Cross-Connect Blocks:

1. The Contractor shall furnish and install 100 pair and/or 300 pair 110 type Insulation Displacement Contact (IDC) punch down cross-connect wiring blocks, TIA Category-5e verified, with mounting legs, for #22 - 26 AWG

conductors; or as specified or Engineer approved equal as indicated on the detailed Engineering Drawings and documents. Install cross-connect blocks on the telephone backboard for termination of user side voice cables and voice tie/trunk cables at the MC/IC/TC's with 110C type c-clip connecting blocks as required. Provide and install preprinted color-coded 110 labels as required to identify cross-connect fields and pairs.

2. The Contractor shall furnish and install distribution rings (D-rings), Systimax 88A retainers, Systimax 188 B/C/D/or E-110-P/P backboards, Systimax 110A/B jumper troughs, Systimax 20A/B wire distribution spools, etc. or Engineer approved equals as indicated and/or required to provide a clean organized cross-connect field with orderly management of cross-connect jumpers. D-rings shall be cast metal; Systimax No. 13A, 13B or 13C or Engineer approved equal.

C. Optical Fiber Cable Hardware:

1. Splice Enclosures:

- a. Splice enclosures are used to enclose and protect optical fiber cable splices from a wide variety of environmental conditions and are classified for indoor or outdoor applications. Splice enclosures shall utilize splice trays which are designed to offer maximum protection for both fusion and mechanical splices of loose tube and tight buffered optical fiber cable designs. The trays are to provide ample bend radius for the fiber preventing induced attenuation. A splice organizer to be mounted in the tray holds and protects the splices. Splice enclosures shall be of the re-enterable type. Outdoor types used in duct, aerial and direct buried applications shall be encapsulatable. Splice enclosures shall be as manufactured by AFL, Preform Line Products (PLP), Tyco/Raychem, Corning or 3M.
- b. Splices for optical fiber cable shall be of fusion type. Optical fiber splices shall not exceed a maximum optical attenuation of 0.05 dB when measured in accordance with TIA-455-54.

2. Interconnect Centers:

- a. Interconnect centers are compact modular units, designed for use as building entrance terminals or in wiring closets to provide storage and protection for optical fiber connections. Unit shall contain mounting provisions for multi-fiber splice trays to facilitate splicing pigtails to the incoming cable or for field termination of cable by allowing a point to secure "fan-out" tubing and support a break-out point for the fibers. Fibers shall terminate on

connectors as noted. The interconnect center shall be as specified on the drawings and contract documents or Engineer approved equal.

3. Modular Optical Fiber Couplers:

a. The modular duplex "LC" coupler fittings for optical fiber cable at the interconnect center adapter panel shall be mechanically compatible with OFS #640-252-056, TIA-604-10 type and TIA-568-C standard "568LC" connectors as specified or Engineer approved equal. All "LC" coupler/adapters are to be provided with dust covers installed.

1) Modular "LC" couplers shall be of the same manufacturer as the "LC" connectors.

4. Optical Fiber Connectors:

a. The fiber cable shall be terminated with permanently installed connectors per TIA-455-21, as noted.

1) 50/125 um multi-mode optical fiber cable may be terminated utilizing spliced factory terminated LC connector pigtail assemblies, as noted.

b. Pigtail Assemblies:

1) The manufacturer of the "pigtail" assembly shall be the connectivity manufacturer. The manufacturer shall provide individual assembly verification and certification testing results. Testing shall include light loss from both directions and at both frequencies, visual mated face and interferometer inspection. All documentation shall be submitted for Engineer/Owner review.

2) Optical fiber pigtail assemblies shall be purchased as four (4) meter jumper assemblies with connectors on both ends, allowing the Contractor to perform random loss verification testing.

3) Contractor shall randomly test 20% of the pigtail (double connectorized) and document the results to verify the manufacturer's submitted test results.

4) The four (4) meter jumper assembly will be cut in two (2) as required for splicing and installation.

5) Factory pre-manufactured and polished multi-mode optical fiber "pigtail" assemblies shall have a maximum optical

- attenuation per connector pair of 0.5 dB.
- 6) Optical fibers utilized for fiber optic "pigtail" assemblies shall be constructed of dispersion and modal matched fiber of the identical manufacture as the optical cable fibers. The Contractor shall provide documentation certifying the fiber match.
- c. Performance Characteristics:
- 1) Maximum optical attenuation per connector pair for a spliced multi-mode pigtail assembly shall be 0.6 dB or less @ 850 nm and 1300 nm.
 - 2) Mean (average) connector pair loss for multi-mode optical fiber shall be 0.3 dB.
 - 3) No more than one (1) maximum loss connector pair or splice shall be permitted per link/channel/segment.
 - 4) Connectivity shall be as specified on the Engineering documents or Engineer approved equal. Contractor shall verify that the connectivity to be provided meets all specifications and requirements.
5. Optical Fiber Splices:
- a. The multi-mode pigtail assemblies shall be mechanically spliced in optical fiber splice trays utilizing mechanical splices of identical manufacture as the connectivity.
 - b. The single-mode pigtail assemblies shall be fusion spliced in optical fiber splice trays utilizing an Engineer approved fusion splicing machine. Contractor shall submit shop drawings/ specification sheets for the equipment proposed to be utilized for the Engineer's review and acceptance. The fusion splices shall be protected with optical fiber heat shrink protective sleeves, 3M #2170 or Engineer approved equal.
 - c. Maximum allowable optical fiber attenuation per mechanical splice for multi-mode fiber shall be 0.05 dB when measured at 850 and 1300 nm.
 - d. Maximum allowable optical fiber attenuation per fusion splice for single-mode fiber shall be 0.05 dB when measured at 1310 and 1550 nm.
 - e. Mean optical fiber attenuation per mechanical splice for multi-mode fiber shall be 0.02 dB when measured at 850 and 1300 nm.
 - f. Mean optical fiber attenuation per fusion splice for single-mode fiber shall be 0.02 dB when measured at 1310 and 1550 nm.
 - g. Optical fiber shall be cleaved to $\leq 0.5^\circ$ perpendicular and cleaned before splicing. The technician shall observe the fusion splice on the splicer scope, verifying an even burn.

- h. Verify the splice utilizing a VFL during the splicing procedure.

2.04 DISTRIBUTION HARDWARE:

A. General:

- 1. The Contractor shall provide voice, data, fiber optic, and CATV cross-connect hardware as per the detailed Engineering Drawings and documents. The cross-connect hardware shall be mounted on equipment racks, in cabinets, or on backboards as indicated on the drawings, in the documents or otherwise required.

B. Backboards:

- 1. Furnish and install in the areas or rooms as indicated on the detailed engineering drawings and documents, for mounting electrical, electronic, data and telecommunication equipment, A/C PLUGGED-INT-APA void-free plywood sheets 48"W x 96"H x 3/4"THK in size, painted with two (2) coatings of fire retardant paint; Flame Control No. 20-20 as available from Glidden, Benjamin Moore, Pittsburg Paint and Sherwin Williams. Unless noted otherwise, plywood sheets shall be installed flush on the finished drywall, block or concrete wall, securely anchored to the building structure, and extending 4" or less from the floor or curb up the wall 8'-0". All data/communication cable conduits shall stub onto either the backboards or onto cable trays and ladder systems.

C. Cable Ladder:

- 1. Cable ladder shall be B-Line/Saunders Type "SB" aluminum cable runway with removable/relocated rungs, in standard bare aluminum finish unless otherwise noted, as indicated on the drawings. The ladder shall be installed per manufacturer's instructions, utilizing manufacturer's accessories and components.

D. Conduits:

- 1. Conduits shall be installed as per Raceway Specification Section of this specification except as noted.
 - a. Conduit size shall be as noted on the drawings, minimum size shall be 1".
 - b. All conduits shall be reamed and furnished with an insulated grounding bushing.
 - c. All entrance conduits shall be IMC or RGS.
 - d. Flexible steel conduit shall not be utilized for telecommunications without specific written approval of the Engineer or the specific

- application.
- e. Exposed exterior conduit shall be IMC or RGS.
 - f. Bend radius for conduits shall be 6x conduit trade size for conduit 2" in diameter or less.
 - g. Bend radius for conduits shall be 10x conduit trade size for conduits over 2" in diameter.
 - h. Conduit sweeps ($\leq 25'$ radius) and bends shall be RGS below grade.
- E. Conduit Boxes and Fittings:
- 1. Conduit boxes and fittings shall be installed as per Specification Sections, except as noted.
 - a. "LB" conduit fittings shall be "Smart LB's" from Conduit Specialties, Inc. Standard "Mogal LB" fittings are unacceptable.
 - b. Conduits shall be provided with "Spillway" fittings by BEJED, Panduit and others, to maintain cable bend radius and support.

PART 3 - EXECUTION

3.01 INTERIOR CABLING:

- A. Whenever possible, primary cable and conduit routing paths shall follow the logical structure of the building (e.g. follow hallways, aisles and corridors whenever possible). When walls must be breached, cables shall pass through pre-established metal conduit sleeved openings. Cables shall enter and/or exit areas at right angles to the structure. Route all data/communication cables and raceways parallel to or perpendicular to the building structure. No diagonal runs will be permitted unless noted otherwise or pre-approved by the Engineer, corridor crossovers shall be kept to a minimum.
- B. For the purpose of this specification, all above ceiling space shall be considered "return air plenum space", unless noted otherwise. All non-plenum rated cables must be routed in conduits or enclosed raceways unless noted otherwise. Contractor to verify "non-plenum" rating requirements.
- C. All power devices and power sources emit a given amount of radio frequency interference (RFI) and/or electro-magnetic interference (EMI). To reduce or eliminate the field effects of RFI/EMI on data traffic on a given cable channel, cable runs shall be kept to the maximum possible distance from such sources. Open wiring or non-metallic raceway shall be routed a minimum of six (6") inches away from fluorescent fixtures. Special attention shall be given to the routing of such pathways away from lighting ballasts and high intensity discharge devices.

The minimum separation distances between data/communication distribution pathways and power wiring of 480 Volts or less are per Table-2 herein.

TABLE-2			
SEPARATION OF DATA/COMMUNICATIONS PATHWAYS FROM $\leq 480V$ POWER LINES			
CONDITION	MINIMUM SEPARATION DISTANCE		
	< 2 kVA	2-5 kVA	> 5 kVA
Unshielded power lines or electrical equipment in proximity to open or nonmetal tel/comm pathways.	6 in	12 in	24 in
Power lines enclosed in a grounded metal conduit (or equivalent shielding) in proximity to open or non-metallic tel/comm pathways	3 in	6 in	12 in
Unshielded power lines or electrical equipment in proximity to a grounded metal conduit tel/comm pathway.	3 in	6 in	12 in
Power lines enclosed in a grounded metal conduit (or equivalent shielding) in proximity to a grounded metal conduit tel/comm pathway.	1/2 the trade Size of the larger conduit	3 in	6 in

- D. Cable ties and supports shall not pinch, bind, crimp or in any way cause physical damage to the data/communication cables. Cables shall be free from tension at both ends and for the entire length of the cable. In cases where a cable or cables must bear some stress (e.g. vertical risers, etc.) "Kellem" grips shall be used to distribute the strain over a longer length of the cable(s). All vertically routed cables shall be neatly bundled and supported on a vertical cable ladder or rings, by means of cable ties on 24" centers or as directed.
- E. Where required to meet maximum cable loads (e.g. for multi-pair trunk and tie cables), a vertical messenger cable shall be installed in the riser. The messenger cable shall be grounded to the data/telecommunication grounding system at both ends and shall not be used in itself as a grounding conductor. The messenger cable shall be utilized to support the multi-pair trunk and tie cables only. Supporting of various and miscellaneous cables or bundles of cables from the messenger will not be approved.
- F. The Contractor shall install multi-pair telephone riser cables as per AT&T Standard Practices #627-610-225.

- G. Cabling Contractor shall take care to assure that during the installation and upon completion, all cables have been installed free from kinks, twists, knots, sharp bends, gouges or cuts to the cable jacket or conductor insulation, or any other physical damage. During installation, the Contractor shall not allow the cables to lay on the floor and be exposed to foot, vehicle or equipment traffic, or be exposed to any other forms of abuse which may pinch, crush, bind, over tension, or in any way cause any physical damage to the data/communication cables. Cables exhibiting such physical damage or an attempt by the Contractor to correct, cover-up, hide or otherwise conceal such damage will be replaced at the Contractor's expense.
- H. Fiber optic backbone cables shall be provided with a minimum 40-foot (12 M) service loop at each end.
- I. The Cabling Contractor shall observe all minimum bend radius and tension limitations, etc. as specified by the cable manufacturer and/or the TIA standards when installing the cables. When conflict exists between specifications, manufacturer recommendations and standards, the more stringent criteria shall apply.
- J. Cables routed from cable trays, cable ladder, channel or other raceways onto the telephone backboard, onto a distribution frame or onto the equipment distribution racks shall be neatly organized and supported by cable support brackets, dropouts, spillways, vertical ladder or other Engineer approved method to minimize tension or stress on cables and the connector block terminations.
- K. All ceiling removal and restoration required for the execution of this work shall be the responsibility of the Contractor.
- L. All items of voice and data equipment, including racks, cables, fiber optic conductors and their respective terminations, shall be identified and labeled as indicated on the detailed Engineering documents, according to TIA-606A standard. Cable identification shall be by means of permanently applied, pre-printed wraparound wire markers (i.e. "Brady-Wrap" B-292, LAT-18, or LAT-19 self-laminating markers or Engineer approved equal). These labels must withstand the requirements of UL969 as outlined in the TIA-606A standard. All interbuilding and backbone subsystem cables shall be labeled at each end. Additional cable labeling shall be required at intermediate locations, such as in pull boxes or where cables pass between floors through sleeves in a riser.
- M. The Contractor shall label all cross-connect wiring blocks with pre-printed color-coded labels. Labels shall be printed with the associated user identification numbers as indicated on the detailed Engineering Drawings and documents. All cables must be terminated and labeled in sequential alphanumeric order on the cross-connect wiring blocks.

- N. The Contractor shall install a permanent engraved laminated phenolic nameplate on each distribution rack frame or equipment cabinet. The nameplate shall be engraved with the distribution frame rack designation as indicated on the drawings (e.g. "IDF-5E Rack 02"). The nameplate shall have 5/16" high black gothic letters on a white background, 1/2" high x length as required.
- O. All 120 VAC rack or cabinet mounted power strips, dedicated power outlets, etc. in the wiring closet and Equipment Room shall be provided with a pre-printed laminated permanently affixed legend plate. The legend plate shall be printed with the receptacle distribution panel identification and circuit number information that the receptacle is served from, if the receptacle is dedicated to a specific piece of equipment or purpose, include that information on the legend plate.
- P. All labeling, nameplates, legend plates, etc. with proposed text, shall be submitted to the Engineer for prior approval. "Dymo Tape Writer" labels, hand written labels, single digit tape markers, etc. are not acceptable.
- Q. The distribution equipment rack frames shall be securely anchored to the floor at all four (4) corners, using anchors into the concrete floor, or toggle bolts through raised floors as per the manufacturer's recommendations and instructions. When specified on the Engineering Drawings and documents or otherwise required, the Contractor shall provide and install "raised floor rack support" kits for the installation of distribution equipment racks on raised floors. The tops of the distribution equipment racks shall be securely tied together and braced from the wall from behind or from structural steel from above.
- R. Free standing cabinets shall be securely anchored to the floor at all four (4) corners, using anchors into the concrete floor, or toggle bolts through the raised floors as per the manufacturer's recommendations and instructions. Wall mounted cabinets and wall mounted racks shall be securely mounted to the walls as required. The Contractor shall provide for the installation of special blocking and bracing as required between studding in the walls, etc. and shall provide additional bracing and support as required from the floor and/or ceiling structure above as approved by the Engineer.
- S. Distribution equipment racks and/or cabinets shall be laid out and located as indicated on the detailed Engineering documents, with vertical cable organizers located between racks. All racks and cabinets shall be bonded to the data/telecommunication grounding system. Patch panels, cable organizers, fiber interconnect cabinets, etc. shall be mounted in the racks and cabinets as indicated on the drawings. Discrepancies or conflicts shall be brought to the attention of the Engineer for resolution, before proceeding with the installation. Power strip installation, cable and cord routing on the equipment rack and/or in the equipment cabinet, shall not obstruct or restrict the mounting of rack

mounted equipment or access to said equipment. The completed distribution equipment rack with installed equipment and/or the completed equipment cabinet with installed equipment shall be such, that there shall be complete unobstructed access to all equipment, components, cables, terminations, etc., without requiring the removal of one item to gain access to another. Each item of equipment shall be removable from the rack or cabinet, without having to remove another piece. No mounting space in the rack or cabinet shall be made unusable by the inappropriate mounting of another component, item or cable routing. Distribution equipment racks and equipment cabinets shall be installed such as, to afford the maximum accessibility and working space in and around the equipment as indicated on the detailed Engineering Drawings. Any discrepancies or conflicts shall be brought to the attention of the Engineer.

- T. The cable ladder installation, when specified in the Communication Room shall be as shown on the detailed Engineering documents. The cable ladder installation shall be self-supporting, independent of the distribution equipment racks, except for the ladder support bar or unistrut support at the top of the rack. The cable ladder shall not be mounted directly to the distribution rack mounting channel or in any way, block access to or the availability of the rack mounting channel. The ladder support bar or unistrut brace shall be utilized approximately every other rack or as required. The unistrut support may when applicable, be extended to the backwall, to act as a brace. Vertical elements of the cable ladder assembly shall be anchored to the floor, using proper end support brackets and anchor bolts per the manufacturer's recommendations and instructions. The cable ladder structure shall be located with the inside rail approximately 6" behind the distribution equipment rack channel. The cable ladder system shall be bonded to the telecommunication grounding system.
- U. Where vertical cable organizers are specified, the power strip shall be mounted centered on the backside of the vertical organizer, between the distribution equipment racks, with the cord to the bottom.
1. Power for the power strips shall be provided by means of a 2-1/2" x 2-1/2" wireway, mounted at the top of the rack/cabinet row. A drop cord shall be provided out of the wire to an appropriate "twist-lock" receptacle, 18" AFF.
 2. The power strip shall be provided with a mating "twist-lock" plug.
 3. In locations where a "in-line" UPS is to be installed, coordinate the plug and receptacle with the UPS.
- V. The data/communication room(s), wiring closet(s), etc. shall contain the mechanical terminations for the voice and data trunk cable terminations, fiber optic backbone cable terminations, distribution and cross-connect fields, patch panels, keyswitch unit (KSU) equipment, private branch exchange (PBX)

equipment, service entrance equipment, surge protection, network system core electronic equipment, etc., which may be furnished and installed as part of the contract and/or by others.

1. Facilities for this equipment and services may or may not be included under this contract and are covered under applicable specifications.
- W. Unless otherwise indicated, equipment racks and wall mounted equipment shall be installed such that a minimum of 36" clearance is available from all sides for installation and maintenance.
- X. Provide a minimum of 12" clearance from the corner to the wall mounted 110 block distribution frame; mount the top of the frame a maximum of 74" off the floor and the bottom of the frame a minimum of 34" off the floor.
- Y. All interbuilding backbone cables, telephone riser and tie cables shall enter the wall mounted cross-connect distribution frame at the bottom right.
- Z. Cast "D" rings shall be utilized only for the support and management of high pair count "voice" backbone cables and fiber optic backbone cables in innerduct. "D" rings shall not be utilized for the support and management of horizontal distribution voice, data, fiber optic and coaxial cables.
- AA. Voice Riser cables shall be arranged on the cross-connect fields in numerical order by cable pair.
- AB. Cooperation, coordination and communication between the different contractors, the Owner and the Engineer is required for the timely scheduling and completion of all elements and components of the installation.
1. It shall be recognized and acknowledged by all participants, that all phases and elements cannot finish the same day, and certain elements and items must be completed prior to the start of other elements.
 2. The Contractor shall provide to the Engineer, at the very start of the project, a construction schedule that is coordinated with the other elements of the project, indicating significant construction and project milestones and completion dates.
 3. This schedule shall be adjusted and modified by the Engineer and/or Project Construction Manager, as required to meet the overall project schedule requirements.
- AC. The Project Construction Manager and others shall be made aware of and understand the importance and necessity for the completion of general contract

work on the data/telecommunication spaces, equipment rooms, etc. prior to the installation of equipment and pulling cables to these areas.

1. The spaces shall be essentially completed, cleaned and secure prior to the installation of equipment and cables.
 2. Equipment racks, cabinets, cable ladders, cable trays, backboards, distribution frames, power, raceways, lighting, HVAC systems, etc. shall be in place prior to pulling any cable in the area.
 3. Pre-pulling cable to the area and building the space around the cable is not acceptable.
- AD. All racks, cabinets, and raceways shall be bonded to the data/telecommunication grounding system as per TIA-607 standard and applicable specifications.
- AE. All cable trays, ladders, equipment racks, cabinets, etc. shall be securely bolted and installed according to the manufacturer's recommendations and instructions. Only factory manufactured parts, accessories and components shall be utilized for the construction, contractor fabricated components and assemblies are subject to the Engineer's approval.
- AF. All unistrut, cable channel, cable tray, cable ladder, bracket, etc. shall be cleanly and squarely cut with the appropriate metal cutting saw, then filed and chamfered clean and free from all burrs and sharp edges. All drilled holes shall be de-burred and chamfered free from sharp edges. Engineer approved chaffing gear shall be provided on all holes, edges, and corners subject to possible cable exposure.
- AG. The Contractor shall remove at his expense, all unusable, unacceptable, or otherwise unapproved cables from the installation, no cable shall be abandoned in place.
- AH. Provide a minimum of one (1) meter (39") of service slack in each fiber optic conductor at each termination or splice. Slack to be coiled on the fiber storage spacer rings provided.

3.02 UNDERGROUND CABLE INSTALLATION:

- A. The recommended procedure for installing interbuilding data/communication cable is in underground ductbanks. Conduit duct banks shall be as per the contract documents herein.
- B. The underground conduit for all data/telecommunication outdoor cable must be dry and waterproof, with the ductbank high in the middle and sloping in both directions towards the manholes for drainage. Manholes shall be provided with

positive drainage.

- C. Ductbanks shall be a minimum 36" below grade and below the frost line. Bond metallic conduit to the grounding system at each end.
- D. A minimum #6 AWG or larger ground conductor shall be run through new ductbank conduit and bonded to the grounding system at each end, and grounded by way of a 5/8" diameter by 8'-0" copperweld ground rod in each manhole.
- E. The conduit ductbank shall be dedicated to interbuilding data/communication cable systems and Class 2 and Class 3 remote control signaling and power limited circuit use only.
- F. Where the ductbank cannot be dedicated as above, the ductbank and manhole system shall not accommodate power and control circuits rated over 300V. All cables passing through manholes shall have an insulation voltage rating equal to that of the highest voltage rating required. Interbuilding data/communication cables in a manhole containing Class 1, electric lighting and/or power conductors or cables shall be separated by means of a brick, concrete or tile partition, per N.E.C. Article 800.
- G. The ductbank should consist of two (2) or more 4" conduit reserved for interbuilding data/communication cable use between manholes and a minimum of two 4" conduits entering the buildings. "Inner duct" of appropriate sizes should be installed in the 4" conduits as required to subdivide and compartmentalize the conduit to allow fullest utilization for present and future requirements. Conduit ductbank should be laid out with a minimum of 3" concrete separation between conduits and an overall 3" thick minimum concrete encasement. Ductbank to be steel reinforced where passing under paved areas or subject to vehicular traffic and extending 5'-0" beyond on either side.
- H. Metallic conduits shall be bonded across manholes, and grounded by means of a 5/8" diameter by 8'-0" copperweld ground rod in each manhole. Bond the manhole cover frame and all other conductive manhole components to the ground rod, utilizing a #6 AWG minimum bonding conductor.
- I. The following pertains to all concrete encased ductbanks; as soon as the ductbanks are poured, and before the concrete sets up, blow a Greenlee type piston through each conduit and leave a 1/8" nylon pull cord in each conduit.
- J. A 1/8" diameter nylon or polypropylene pull rope shall be installed in all conduits and inner ducts.
- K. Where and when indicated on the engineering drawings, Contractor to provide, at each manhole, sufficient slack in each data/communication cable for a 15'-0"

service loop above the opening. Slack cable to be Figure 8 coiled, tied, tagged and hung off the bottom on rack hooks.

- L. Splices shall only be made in manholes at approved designated locations. All cable runs are to be installed as single continuous pulls from building termination to building termination. No "in-line" connections will be permitted, splices shall be permitted as indicated on the drawings only, or with Engineer's written approval. Splice enclosures shall be supported up on the cable rack off the bottom, and identified by cable number.
- M. All data/communication cables passing through a manhole shall be tagged with a permanent type tag within 12" of each conduit entrance. The permanent tag shall be a laminated plastic or stamped metal type, attached to the cable with plastic cable ties or metal straps. Cable tag shall be submitted to the Engineer for prior approval.

3.03 MISCELLANEOUS:

A. Cable Marking and Labeling:

- 1. All interbuilding data/communication cables, upon entering a building and at other appropriate locations as indicated, shall be tagged with a permanent type tag within 12" of each conduit entrance. The permanent tag shall be a laminated plastic or stamped metal type, attached to the cable with plastic cable ties or metal straps. Cable tag shall be submitted to the Engineer for prior approval.

B. Flooded Cables:

- 1. All flooded or "filled" cables shall be sealed as per the manufacturer's procedures and specifications and/or Engineer approved procedure and method.

3.04 SYSTEMS TESTING AND VERIFICATION:

A. General:

- 1. Upon completion of the cable installation, the Contractor shall perform and submit for approval, complete cable documentation and verification testing reports. Required testing and reports shall include, but shall not be limited to providing the following information:
 - a. Continuity check of all cable, all pairs, checking for opens and shorts.
 - b. Determining and recording all cable lengths.
 - c. Checking all cables, all pairs for proper termination and correct

- d. pair polarity.
 - d. Verifying correct cable labeling at both ends of the cable; the demarcation point, and the cross connect field and patch panel labeling.
 - e. Test equipment model and serial number.
 - f. Date testing was performed and the name of the Technician/Operator performing the tests and/or inspections.
 - g. Completing test all data/telecommunications and fiber optic cables installed and terminated by the Contractor, including but not limited to multi-twisted pair trunk, riser and tie cables, coaxial CATV Broadband, and multimode/single-mode fiber optic cables as described herein.
2. The purpose of the systems testing and verification requirements are twofold:
- a. To verify and document that the completed installation meets or exceeds minimum systems performance and quality standards as outlined herein.
 - b. Establish a standard base criteria against which the completed installation can be tested and compared to in the future, to facilitate troubleshooting and maintenance.
3. The Contractor shall at the onset of the project, submit to the Engineer for approval cut sheets, shop drawings, technical specifications, operator manuals, etc. as provided by the manufacturer of the testing equipment proposed for use by the Contractor, to test and verify his installation.
4. The Contractor shall provide 48 hour prior notice to the Engineer before commencing cable testing. The Engineer shall, at the Engineer's discretion, observe any and/or all cable testing procedures. Cable testing procedures shall be acceptable to the Engineer.
5. The Contractor shall prepare complete cable test reports for all installed cables for review and acceptance by the Engineer prior to acceptance of the cabling installation.
6. The Contractor shall perform minimum verification testing of all cables on the reels before pulling and installation. The Contractor shall be responsible for all cable installed, and all cable must be fully acceptable and verified upon completion.
- B. 100 Ohm Multi-Twisted Pair Telephone Exchange Cable:
- 1. All cables and all pairs shall be tested for opens, shorts, continuity, pair-

reversals (flips), and inspected for proper 25-pair color code sequence, 25-pair primary unit color code sequence, and 100-pair multi-unit color code designation termination sequence. In addition, the first pair in each 25-pair binder group, shall be tested for loop-resistance to the nearest 0.1 Ohms. Test and inspection results shall be recorded on Test Report Form 2, included herein or Engineer approved equal.

C. Multimode and Single-Mode Optical Fiber Systems:

1. All optical fiber cables shall be fully tested and verified to Tier 2 Certification.
 - a. TIA TSB-140 includes two (2) tiers of testing. Tier 1 accommodates loss and length testing with an optical loss test set (OLTS). Tier 2 testing includes the parameters of Tier 1 and also an OTDR trace of the installed cable link.
 - b. Tier 1 and Tier 2 testing shall be performed, recorded and submitted as full bi-directional and bi-frequency for each strand.
2. All optical fiber cables shall be visually inspected for connector end face grading (photo recorded; 250x magnification for multi-mode, 400x magnification for single-mode, minimum) and Visual Fault Locator (VFL) inspected.
3. Optical fiber cable testing shall be conducted by an Engineer approved testing facility, utilizing a programmable micro-computer based Automatic Optical Time Domain Reflectometer and Optical Loss Test Set with built-in electronic fiber end-face microscope and a Visual Fault Locator.
 - a. The Fluke "Opti-Fiber" certifying OTDR or Engineer approved equal shall be utilized for verification testing of optical fiber cables.
 - b. All optical fiber test results shall be submitted in a Fluke "Linkware" software compatible format.
4. Each fiber conductor shall be visually inspected and tested with the cable completely installed and in final placement, with connectors installed, finished and clean.
 - a. Fiber conductor shall be inspected for proper termination techniques, workmanship, labeling, cleanliness, etc.
 - b. All connector installations exhibiting defects and/or improper installation procedures shall be replaced at the Contractor's expense.
5. Each fiber shall be tested at both frequencies, in both directions, with all

readings recorded and submitted. The worst case readings will be utilized to determine acceptability of the fiber.

6. The technician performing the fiber optical loss testing shall periodically check and verify the reference dB loss.
7. The Contractor shall provide his optical fiber test equipment with high quality, high performance, low loss optical fiber test jumpers, launch and receiver cords.
8. All OTDR tests shall be performed utilizing both launch and receiver cords provided by the OTDR tester manufacturer.
9. It is recommended that the Contractor utilize test jumpers between the launch/receiver cords and the fiber under test to minimize wear and contamination of the launch/receiver cord connectors. Older and worn launch cords may be utilized as receiver cords if undamaged.
10. The optical fiber cable test report shall provide the following information:
 - a. Contractor's Name
 - b. Test Equipment Identification: Manufacturer, model number and serial number
 - c. Client/Owner Identification
 - d. Date Test Performed
 - e. Cable Manufacturer and Part Number
 - f. Cable Identification Number
 - g. Cable Location (i.e. Building – From/To)
 - h. Cable Description (i.e. Number of Fibers, S/M, M/M)
 - i. Name of Technician Performing the Tests
 - j. Cable Length
 - k. Reflectance
 - l. Link Attenuation (Loss) Measurement in dB per Fiber
 - m. Reference dB Loss (Tare Value)
 - n. Visual Connector Inspection Verification (Both Ends)
 - o. Calculated Fiber Loss Based on Fiber Length, Factory Average Fiber Loss Specifications, Number of Splices and Number of Connector Pairs
11. Optical fiber shall be tested end-to-end as a complete segment, link or loop, dependent upon the installation.
 - a. Segments are to be tested end-to-end.
 - b. Links are to be tested end-to-end with cross-connect fields patched through.
 - c. Redundant loops shall be patched through and tested as a single

link all the way around.

12. Optical fiber cable certification testing and acceptance shall be determined by the installation meeting or exceeding the "Link Loss Budget Calculation" for each strand as follows:
 - a. $(\text{Fiber Length} \times \text{Mean Loss Per Length}) + (\text{No. of Connector Pairs} \times \text{Mean Connector Pair Loss}) + \text{No. of Allowable Splices} \times \text{Mean Splice Loss} = \text{"Link Loss Budget"}$

Example: 3.2 Km SM Loose Tube Loop, with 4 "LC" Connector Pairs, 4 Pigtail Splices, 1 Segment Splice; calculates as: $(3.2 \text{ Km} \times 0.4 \text{ dB/Km}) + 4 \times 0.2 \text{ dB} + (5 \times 0.02 \text{ dB}) = 2.18 \text{ dB}$ "Link Loss Budget" (Note – No single item shall exceed its maximum allowed loss, only one maximum loss of each item per link)
13. It is recognized and intended that this specification is more stringent than the TIA-568-C3 Annex "H" standard.
14. Copies of the optical fiber cable test results shall be provided in electronic Fluke Linkware compatible format.
15. Copies of the optical fiber cable visual inspection results shall be provided by the Contractor manually completing Inspection Report Form 4, included herein or Engineer approved equal.

3.05 SUBMITTALS

A. Record Drawings:

1. The Contractor shall keep in the field and open to inspection, an accurate, current, progressive record of the actual installation of the data/communication cabling system. Upon completion of the work, the Contractor shall deliver marked up prints showing the actual routing of cable runs, outlet locations, outlet/cable identifications, cable tray sizes and routes, conduit sizes and routes, distribution frame layouts, punchdown block locations, coaxial cable system splitter and tap locations with dB values and signal levels indicating system loading and balancing, etc.
2. Where applicable or otherwise noted on the Engineering Drawings or documents, the Engineer will provide to the Contractor AutoCAD/PDF files of the appropriate available floor plans and/or drawings as required

for the Contractor to update and/or provide the required record documentation.

B. Cabling System Instruction Manuals:

1. Provide complete written system instruction manuals, which shall include, but not be limited to the following:
 - a. First Page: Title of job, Owner, address, date of submittal and name of Contractor.
 - b. Second Page: Index of Contents
 - c. Third Page: Introduction to first section containing a cross-reference to the equipment schedule and cable schedule.
 - d. First Section: One copy each of accepted shop drawings, equipment catalog cuts and manufacturer's instructions for all components and materials utilized in the data/communication cabling system.
 - e. Second Section: One copy each of accepted test equipment catalog cuts, operating instructions and manufacturer's test instructions and procedures as incorporated into the testing of the data/communication cabling system.
 - f. Third Section: One copy each of completed and accepted cable test reports unless noted otherwise.
2. Bind the written system instruction manual's information and materials into a hardback binder of 8-1/2" x 11" size.
3. Submit two (2) copies to the Engineer for approval.
4. After approval, submit four (4) copies to the Engineer for delivery to the Owner.
5. Submit two (2) complete sets of record drawings to the Engineer for review.

END OF SECTION 27 1300

TABLE 1 -- DATA/COMMUNICATIONS CONDUIT/RACEWAY FILL SCHEDULE

Cable Max. O.D. (in.)		0.31		0.37		0.53		0.62		0.70		0.89		0.97		1.07		1.30		1.50	
Cable Area (sq. in.)		0.075		0.108		0.22		0.302		0.387		0.62		0.74		0.90		1.33		1.77	
Conduit Size (in) Raceway/Tray Size	Avail. Area (sq.in.) (Note 5)	BICSI	NEC																		
1" Conduit	0.34	3	4	2	3	1	1	0	1	-	-	-	-	-	-	-	-	-	-	-	-
1-1/4" Conduit	0.60	4	8	3	5	1	2	1	1	1	1	-	-	-	-	-	-	-	-	-	-
1-1/2" Conduit	0.82	6	10	4	7	2	3	1	2	1	1	0	1	0	1	-	-	-	-	-	-
2" Conduit	1.34	12	17	7	12	4	6	3	4	2	3	1	1	1	1	1	1	0	1	0	1
2-1/2" Conduit	1.92	14	25	12	17	6	8	3	6	3	4	2	3	2	2	1	1	1	1	0	1
3" Conduit	2.95	20	39	17	27	7	13	6	9	6	7	3	4	3	4	1	3	1	1	1	1
3-1/2" Conduit	3.96	36	52	22	36	12	18	7	13	6	10	4	6	4	5	3	4	2	3	1	2
4" Conduit	5.09	47	67	30	47	14	23	12	16	7	13	5	8	5	7	4	5	2	3	1	2
3"x1" Channel	1.50	11	20	7	14	3	6	2	5	2	3	1	2	1	2	0	1	0	1	0	0
4"x1-3/4" Channel	3.50	26	46	18	33	8	16	6	11	5	9	3	5	3	5	2	4	1	2	1	2
6"x1-3/4" Channel	5.25	39	70	27	49	13	23	9	17	7	13	4	8	5	7	3	6	2	4	1	3
6"x3" Tray	9.00	67	120	46	83	22	40	16	30	13	23	8	14	9	12	5	10	3	6	3	5
12"x3" Tray	18.00	134	240	93	166	45	81	33	60	26	46	16	29	18	24	11	20	7	13	5	10
18"x3" Tray	27.00	201	360	140	250	68	122	50	90	39	69	24	43	27	36	16	30	11	20	8	15
24"x3" Tray	36.00	268	480	186	334	91	163	66	120	52	92	32	58	36	49	22	40	14	26	10	20

NOTES:

1. BICSI column equals BICSI recommended maximum number of cables.
2. NEC column equals NEC calculated maximum number of cables.
3. Maximum NEC fill is calculated at 40% fill conduit (for three or more cables), 50% tray/channel.
Recommended BICSI fill is based on EIA/TIA-569A guidelines and assumes no more than two 90 degree bends for a horizontal conduit and a 28% fill factor for the conduit.
4. Available area (square inch) calculated at 40% fill for conduits, 50% fill for tray/channel. Adjust conduit fill as required for 53% fill for one cable or 31% fill for two.
- 5.
6. **The Contractor shall be responsible for sizing the raceway to recommended BICSI maximum fills.**

TABLE-1

Lucas County Board of Commissioners
Renovations to Buildings B, C and D
Holland, Ohio

CABLE VERIFICATION TEST REPORT

Cable Identification No.: _____ Cable Length: _____
 Manufacturer: _____ Catalog No.: _____
 Cable Size: _____ Pairs, _____ AWG Cable Type: _____
 100 Pair Multiunit Designation: _____ 25 Pair Primary Unit Color: _____
 Required Shop Drawings, Test Equipment and Test Procedure Submittals Made and Approved: () Yes () No

Color Code	Tip/Ring	Pair No.	C/C Block Posit	Pin Term. (1)	Cont. (2)	Short (3)	X Pr. (4)	Rev. Pr. (5)	Spt. Pr. (6)	Pr. Res. (7)	Act. Test (8)	Remarks
WHT/BLU	T 1	1	1									
BLU/WHT	R 1		2									
WHT/ORG	T 2	2	3							---		
ORG/WHT	R 2		4							---		
WHT/GRN	T 3	3	5							---		
GRN/WHT	R 3		6							---		
WHT/BRN	T 4	4	7							---		
BRN/WHT	R 4		8							---		
WHT/SLA	T 5	5	9							---		
SLA/WHT	R 5		10							---		
RED/BLU	T 6	6	11							---		
BLU/RED	R 6		12							---		
RED/ORG	T 7	7	13							---		
ORG/RED	R 7		14							---		
RED/GRN	T 8	8	15							---		
GRN/RED	R 8		16							---		
RED/BRN	T 9	9	17							---		
BRN/RED	R 9		18							---		
RED/SLA	T 10	10	19							---		
SLA/RED	R 10		20							---		
BLK/BLU	T 11	11	21							---		
BLU/BLK	R 11		22							---		
BLK/ORG	T 12	12	23							---		
ORG/BLK	R 12		24							---		
BLK/GRN	T 13	13	25							---		
GRN/BLK	R 13		26							---		
BLK/BRN	T 14	14	27							---		
BRN/BLK	R 14		28							---		
BLK/SLA	T 15	15	29							---		
SLA/BLK	R 15		30							---		
YEL/BLU	T 16	16	31							---		
BLU/YEL	R 16		32							---		
YEL/ORG	T 17	17	33							---		
ORG/YEL	R 17		34							---		
YEL/GRN	T 18	18	35							---		
GRN/YEL	R 18		36							---		
YEL/BRN	T 19	19	37							---		
BRN/YEL	R 19		38							---		
YEL/SLA	T 20	20	39							---		
SLA/YEL	R 20		40							---		
VIO/BLU	T 21	21	41							---		
BLU/VIO	R 21		42							---		
VIO/ORG	T 22	22	43							---		
ORG/VIO	R 22		44							---		
VIO/GRN	T 23	23	45							---		
GRN/VIO	R 23		46							---		
VIO/BRN	T 24	24	47							---		
BRN/VIO	R 24		48							---		
VIO/SLA	T 25	25	49							---		
SLA/VIO	R 25		50							---		

Legend:
 (1) Proper color coded conductor pin termination at each end. (5) No reversed pairs.
 (2) Continuity to remote end, no splices, etc. (6) No split pairs.
 (3) No shorts between any two or more conductors or to ground. (7) Pair loop resistance to 1/100 OHM.
 (4) No crossed pairs. (8) Active tests performed, Owner accepted - initial and date.

Contractor: _____ Title: _____
 Tested/Inspected By: _____ Date: _____
 Signed: _____ Date: _____

ENGINEERING REVIEW
 Reviewed By: _____
 Date: _____

FORM 2: 100 OHM MULTI-TWISTED PAIR TEST REPORT

PG. ____ OF ____

