

PROJECT MANUAL - VOLUME 2
Div 1 – Div 14

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MULTI-PURPOSE FACILITY
Bid Package 2

for

Joliet Junior College

1215 Houbolt Road
Joliet, Illinois 60431



DEMONICA KEMPER ARCHITECTS

125 N. Halsted Street, Suite 301
Chicago, Illinois 60661
Phone: 312.496.0000

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SECTION 01 23 00 - 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

- A. Alternate No. 1: State the amount to add to the lump sum base bid for providing Storage Room 1015 as shown in the documents.
- B. Alternate No. 2: State the amount to add to the lump sum base bid for providing Storage Room 1015 as shown in the documents.
- C. Alternate No. 3: State the amount to add to the lump sum base bid for providing Storage Room 1015 and Storage Room 1016 as shown in the documents.
- D. Alternate No. 4: State the amount to add to the lump sum base bid for providing Sound-Absorbing Wall Units, type AWP-3, to extents shown in the documents.
- E. Alternate No. 5: State the amount to add to the lump sum base bid for providing the portable artificial turf flooring in the Field House/Competition space, and for revising the rubber sports floor product in the Field House.

END OF SECTION 01 23 00

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 012300 "Alternates" for products selected under an alternate.
 - 2. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

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 CSI Form 13.1A.
 - 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. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
- j. 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.
- k. Cost information, including a proposal of change, if any, in the Contract Sum.
- l. 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.
- m. 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 15 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 for achieving LEED prerequisites and credits.
 - 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 the Notice to Proceed. 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 for achieving LEED prerequisites and credits.

- 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)

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION 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 handling and processing Contract modifications.
- B. Related Requirements:
 - 1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

1.3 MINOR CHANGES IN THE WORK

- A. Architect will issue through Construction Manager supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions" or similar form.

1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Construction Manager will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Work Change Proposal Requests issued by Construction Manager are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - e. Quotation Form: Use forms acceptable to Architect.

- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Construction Manager.
1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 4. Include costs of labor and supervision directly attributable to the change.
 5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
 7. Proposal Request Form: Use form provided by Owner. Sample copy is included in Project Manual. form acceptable to Architect.

1.5 ADMINISTRATIVE CHANGE ORDERS

- A. Allowance Adjustment: See Section 012100 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.
- B. Unit-Price Adjustment: See Section 012200 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.6 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Changes Proposal Request, Construction Manager will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.7 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect or Construction Manager may issue a Construction Change Directive on AIA Document G714 or similar form. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 - 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 01 33 00 - 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.
 - 3. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's and Construction Manager'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 and Construction Manager'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

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time

required for making corrections or revisions to submittals noted by Architect and Construction Manager and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Architect's and Construction Manager's final release or approval.
 - g. Scheduled date of fabrication.
 - h. Scheduled dates for purchasing.
 - i. Scheduled dates for installation.
 - j. Activity or event number.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.
 1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.
 - a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
 - b. Digital Drawing Software Program: The Contract Drawings are available in Autodesk Revit 2014.
 - c. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.
 - d. .
 - e. The following digital data files will by furnished for each appropriate discipline:
 - 1) Floor plans.
 - 2) Reflected ceiling plans.
- 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 and Construction Manager reserve 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 Construction Manager'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. Construction Manager 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.
 - a. Architectural Precast Panels will require an extended review period, so multiple trades must coordinate type, location, and quantity of embedded junction boxes; and size and routing of embedded conduit.
 5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Construction Manager, through Architect, before being returned to Contractor.
- 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 and Construction Manager.
 4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software electronic form acceptable to Owner, containing the following information:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Name of firm or entity that prepared submittal.
 - g. Names of subcontractor, manufacturer, and supplier.
 - h. Category and type of submittal.
 - i. Submittal purpose and description.
 - j. Specification Section number and title.
 - k. Specification paragraph number or drawing designation and generic name for each of multiple items.
 - l. Drawing number and detail references, as appropriate.
 - m. Location(s) where product is to be installed, as appropriate.
 - n. Related physical samples submitted directly.
 - o. Indication of full or partial submittal.
 - p. Transmittal number[, numbered consecutively].
 - q. Submittal and transmittal distribution record.
 - r. Other necessary identification.
 - s. 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 and Construction Manager 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 and Construction Manager'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 and Construction Manager'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 as PDF electronic files directly to Project Web site specifically established for Project.
 - a. Architect, through Construction Manager, 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 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. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 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.
 - g. Seal and signature of professional engineer if specified.
 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, but no larger than 30 by 42 inches.
 3. Submit Shop Drawings in the following format:
 - a. PDF electronic file.
 4. BIM File Incorporation: Develop and incorporate Shop Drawing files into Building Information Model established for Project.
 - a. Prepare Shop Drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.
- 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, through Construction Manager, 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 at least three sets of Samples. Architect and Construction Manager will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
 - 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] <Insert number> sets of paired units that show approximate limits of variations.

- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
 - 1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 - 2. Manufacturer and product name, and model number if applicable.
 - 3. Number and name of room or space.
 - 4. Location within room or space.
 - 5. Submit product schedule in the following format:
 - a. PDF electronic file.

- F. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."

- G. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."

- H. LEED Submittals: Comply with requirements specified in Section 018113.13 "Sustainable Design Requirements - LEED for New Construction and Major Renovations."
- I. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- J. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- K. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- L. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- M. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- N. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- O. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- P. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- Q. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
1. Name of evaluation organization.
 2. Date of evaluation.
 3. Time period when report is in effect.
 4. Product and manufacturers' names.
 5. Description of product.
 6. Test procedures and results.
 7. Limitations of use.
- R. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

- S. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- T. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- U. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

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 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.
- C. BIM File Incorporation: Incorporate delegated-design drawing and data files into Building Information Model established for Project.
 - 1. Prepare delegated-design drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.

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 and Construction Manager.

- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 01 77 00 "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 AND CONSTRUCTION MANAGER'S ACTION

- A. Action Submittals: Architect and Construction Manager will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect and Construction Manager will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- B. Informational Submittals: Architect and Construction Manager will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect and Construction Manager 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 and Construction Manager.
- 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 01 33 00

SECTION 014200 - REFERENCES

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 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

AA	Aluminum Association (The) www.aluminum.org	(703) 358-2960
AABC	Associated Air Balance Council www.aabchq.com	(202) 737-0202
AAMA	American Architectural Manufacturers Association www.aamanet.org	(847) 303-5664
AASHTO	American Association of State Highway and Transportation Officials www.transportation.org	(202) 624-5800
AATCC	American Association of Textile Chemists and Colorists www.aatcc.org	(919) 549-8141
ABAA	Air Barrier Association of America www.airbarrier.org	(866) 956-5888
ABMA	American Bearing Manufacturers Association www.abma-dc.org	(202) 367-1155
ACI	American Concrete Institute www.concrete.org	(248) 848-3700
ACPA	American Concrete Pipe Association www.concrete-pipe.org	(972) 506-7216
AEIC	Association of Edison Illuminating Companies, Inc. (The) www.aeic.org	(205) 257-2530
AF&PA	American Forest & Paper Association www.afandpa.org	(800) 878-8878 (202) 463-2700
AGA	American Gas Association www.aga.org	(202) 824-7000
AHAM	Association of Home Appliance Manufacturers www.aham.org	(202) 872-5955

AHRI	Air-Conditioning, Heating, and Refrigeration Institute, The www.ahrinet.org	(703) 524-8800
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AIA	American Institute of Architects (The) www.aia.org	(800) 242-3837 (202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
AITC	American Institute of Timber Construction www.aitc-glulam.org	(303) 792-9559
ALSC	American Lumber Standard Committee, Incorporated www.alsc.org	(301) 972-1700
AMCA	Air Movement and Control Association International, Inc. www.amca.org	(847) 394-0150
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
AOSA	Association of Official Seed Analysts, Inc. www.aosaseed.com	(405) 780-7372
APA	APA - The Engineered Wood Association www.apawood.org	(253) 565-6600
APA	Architectural Precast Association www.archprecast.org	(239) 454-6989
API	American Petroleum Institute www.api.org	(202) 682-8000
ARI	Air-Conditioning & Refrigeration Institute www.ari.org	(703) 524-8800
ARMA	Asphalt Roofing Manufacturers Association www.asphaltroofing.org	(202) 207-0917
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute (See ASCE)	
ASHRAE	American Society of Heating, Refrigerating and Air- Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400

ASME	ASME International (American Society of Mechanical Engineers International) www.asme.org	(800) 843-2763 (973) 882-1170
ASSE	American Society of Sanitary Engineering www.asse-plumbing.org	(440) 835-3040
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9500
ATIS	Alliance for Telecommunications Industry Solutions www.atis.org	(202) 628-6380
AWCMA	American Window Covering Manufacturers Association (Now WCMA)	
AWCI	Association of the Wall and Ceiling Industry www.awci.org	(703) 534-8300
AWI	Architectural Woodwork Institute www.awinet.org	(571) 323-3636
AWPA	American Wood Protection Association (Formerly: American Wood Preservers' Association) www.awpa.com	(205) 733-4077
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
BIA	Brick Industry Association (The) www.bia.org	(703) 620-0010
BICSI	BICSI, Inc. www.bicsi.org	(800) 242-7405 (813) 979-1991
BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association International) www.bifma.com	(616) 285-3963
BISSC	Baking Industry Sanitation Standards Committee www.bissc.org	(866) 342-4772
CCC	Carpet Cushion Council www.carpetcushion.org	(610) 527-3880
CDA	Copper Development Association www.copper.org	(800) 232-3282 (212) 251-7200

CEA	Canadian Electricity Association www.canelect.ca	(613) 230-9263
CEA	Consumer Electronics Association www.ce.org	(866) 858-1555 (703) 907-7600
CFFA	Chemical Fabrics & Film Association, Inc. www.chemicalfabricsandfilm.com	(216) 241-7333
CGA	Compressed Gas Association www.cganet.com	(703) 788-2700
CIMA	Cellulose Insulation Manufacturers Association www.cellulose.org	(888) 881-2462 (937) 222-2462
CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	(630) 584-1919
CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(423) 892-0137
CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org	(301) 596-2583
CPA	Composite Panel Association www.pbmdf.com	(703) 724-1128
CRI	Carpet and Rug Institute (The) www.carpet-rug.com	(800) 882-8846 (706) 278-3176
CRRC	Cool Roof Rating Council www.coolroofs.org	(866) 465-2523 (510) 485-7175
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(847) 517-1200 (800) 328-6306
CRRC	Cool Roof Rating Council www.coolroofs.org	(866) 465-2523 (510) 485-7175
CSA	Canadian Standards Association www.csa.ca	(800) 463-6727 (416) 747-4000
CSA	CSA International (Formerly: IAS - International Approval Services) www.csa-international.org	(866) 797-4272 (416) 747-4000
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
CSSB	Cedar Shake & Shingle Bureau www.cedarbureau.org	(604) 820-7700
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute) www.cti.org	(281) 583-4087

DHI	Door and Hardware Institute www.dhi.org	(703) 222-2010
ECA	Electrical Components Association www.ec-central.org	(703)907-8024
EIA	Electronic Industries Alliance www.eia.org	(703) 907-7500
EIMA	EIFS Industry Members Association www.eima.com	(800) 294-3462 (770) 968-7945
EJCDC	Engineers Joint Contract Documents Committee http://content.asce.org/ejcdc/	(703) 295-6000
EJMA	Expansion Joint Manufacturers Association, Inc. www.ejma.org	(914) 332-0040
ESD	ESD Association (Electrostatic Discharge Association) www.esda.org	(315) 339-6937
ETL SEMCO	Intertek ETL SEMCO (Formerly: ITS - Intertek Testing Service NA) www.intertek-etlsemko.com	(800) 967-5352
FIBA	Federation Internationale de Basketball (The International Basketball Federation) www.fiba.com	41 22 545 00 00
FIVB	Federation Internationale de Volleyball (The International Volleyball Federation) www.fivb.ch	41 21 345 35 35
FM Approvals	FM Approvals LLC www.fmglobal.com	(781) 762-4300
FM Global	FM Global (Formerly: FMG - FM Global) www.fmglobal.com	(401) 275-3000
FRSA	Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc. www.floridarroof.com	(407) 671-3772
FSA	Fluid Sealing Association www.fluidsealing.com	(610) 971-4850
FSC	Forest Stewardship Council www.fsc.org	49 228 367 66 0
GA	Gypsum Association www.gypsum.org	(301) 277-8686
GANA	Glass Association of North America	(785) 271-0208

	www.glasswebsite.com	
GRI	(Part of GSI)	
GS	Green Seal www.greenseal.org	(202) 872-6400
GSI	Geosynthetic Institute www.geosynthetic-institute.org	(610) 522-8440
HI	Hydronics Institute www.gamanet.org	(908) 464-8200
HI/GAMA	Hydronics Institute/Gas Appliance Manufacturers Association Division of Air-Conditioning, Heating, and Refrigeration Institute (AHRI) www.ahrinet.org	(908) 464-8200
HMMA	Hollow Metal Manufacturers Association (Part of NAAMM)	
HPVA	Hardwood Plywood & Veneer Association www.hpva.org	(703) 435-2900
HPW	H. P. White Laboratory, Inc. www.hpwhite.com	(410) 838-6550
IAPSC	International Association of Professional Security Consultants www.iapsc.org	(515) 282-8192
ICBO	International Conference of Building Officials www.iccsafe.org	(888) 422-7233
ICEA	Insulated Cable Engineers Association, Inc. www.icea.net	(770) 830-0369
ICRI	International Concrete Repair Institute, Inc. www.icri.org	(847) 827-0830
ICPA	International Cast Polymer Association www.icpa-hq.org	(703) 525-0320
IEC	International Electrotechnical Commission www.iec.ch	41 22 919 02 11
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org	(212) 419-7900
IES	Illuminating Engineering Society of North America www.iesna.org	(703) 525-0320
IEST	Institute of Environmental Sciences and Technology www.iest.org	(847) 255-1561
IGMA	Insulating Glass Manufacturers Alliance www.igmaonline.org	(613) 233-1510

ILI	Indiana Limestone Institute of America, Inc. www.iliai.com	(812) 275-4426
ISA	Instrumentation, Systems, and Automation Society, The www.isa.org	(919) 549-8411
ISO	International Organization for Standardization www.iso.ch	41 22 749 01 11
ISSFA	International Solid Surface Fabricators Association www.issfa.net	(877) 464-7732 (801) 341-7360
ITS	Intertek Testing Service NA (Now ETL SEMCO)	
ITU	International Telecommunication Union www.itu.int/home	41 22 730 51 11
KCMA	Kitchen Cabinet Manufacturers Association www.kcma.org	(703) 264-1690
LGSEA	Light Gauge Steel Engineers Association www.arcat.com	(202) 263-4488
LMA	Laminating Materials Association (Now part of CPA)	
LPI	Lightning Protection Institute www.lightning.org	(800) 488-6864
MBMA	Metal Building Manufacturers Association www.mbma.com	(216) 241-7333
MCA	Metal Construction Association www.metalconstruction.org	(847) 375-4718
MFMA	Maple Flooring Manufacturers Association, Inc. www.maplefloor.org	(888) 480-9138
MFMA	Metal Framing Manufacturers Association, Inc. www.metalframingmfg.org	(312) 644-6610
MH	Material Handling (Now MHIA)	
MHIA	Material Handling Industry of America www.mhia.org	(800) 345-1815 (704) 676-1190
MIA	Marble Institute of America www.marble-institute.com	(440) 250-9222
MPI	Master Painters Institute www.paintinfo.com	(888) 674-8937 (604) 298-7578
MSS	Manufacturers Standardization Society of The Valve and	(703) 281-6613

	Fittings Industry Inc. www.mss-hq.com	
NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	(630) 942-6591
NACE	NACE International (National Association of Corrosion Engineers International) www.nace.org	(800) 797-6223 (281) 228-6200
NADCA	National Air Duct Cleaners Association www.nadca.com	(202) 737-2926
NAGWS	National Association for Girls and Women in Sport www.aahperd.org/nagws/	(800) 213-7193, ext. 453
NAIMA	North American Insulation Manufacturers Association www.naima.org	(703) 684-0084
NBGQA	National Building Granite Quarries Association, Inc. www.nbgqa.com	(800) 557-2848
NCAA	National Collegiate Athletic Association (The) www.ncaa.org	(317) 917-6222
NCMA	National Concrete Masonry Association www.ncma.org	(703) 713-1900
NCTA	National Cable & Telecommunications Association www.ncta.com	(202) 222-2300
NEBB	National Environmental Balancing Bureau www.nebb.org	(301) 977-3698
NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NelMA	Northeastern Lumber Manufacturers' Association www.nelma.org	(207) 829-6901
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NETA	InterNational Electrical Testing Association www.netaworld.org	(888) 300-6382 (269) 488-6382
NFHS	National Federation of State High School Associations www.nfhs.org	(317) 972-6900
NFPA	NFPA (National Fire Protection Association) www.nfpa.org	(800) 344-3555 (617) 770-3000
NFRC	National Fenestration Rating Council www.nfrc.org	(301) 589-1776

NGA	National Glass Association www.glass.org	(866) 342-5642 (703) 442-4890
NHLA	National Hardwood Lumber Association www.natlhardwood.org	(800) 933-0318 (901) 377-1818
NLGA	National Lumber Grades Authority www.nlga.org	(604) 524-2393
NOFMA	NOFMA: The Wood Flooring Manufacturers Association (Formerly: National Oak Flooring Manufacturers Association) www.nofma.org	(901) 526-5016
NOMMA	National Ornamental & Miscellaneous Metals Association www.nomma.org	(888) 516-8585
NRCA	National Roofing Contractors Association www.nrca.net	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400
NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
NSSGA	National Stone, Sand & Gravel Association www.nssga.org	(800) 342-1415 (703) 525-8788
NTMA	National Terrazzo & Mosaic Association, Inc. (The) www.ntma.com	(800) 323-9736 (540) 751-0930
NWFA	National Wood Flooring Association www.nwfa.org	(800) 422-4556 (636) 519-9663
PCI	Precast/Prestressed Concrete Institute www.pci.org	(312) 786-0300
PDI	Plumbing & Drainage Institute www.pdionline.org	(800) 589-8956 (978) 557-0720
PGI	PVC Geomembrane Institute http://pgi-tp.cee.uiuc.edu	(217) 333-3929
PTI	Post-Tensioning Institute www.post-tensioning.org	(248) 848-3180
RCSC	Research Council on Structural Connections www.boltcouncil.org	
RFCI	Resilient Floor Covering Institute www.rfci.com	(706) 882-3833
RIS	Redwood Inspection Service www.redwoodinspection.com	(925) 935-1499

SAE	SAE International www.sae.org	(877) 606-7323 (724) 776-4841
SCAQMD	South Coast Air Quality Management District www.aqmd.com	(909) 396-2000
SCTE	Society of Cable Telecommunications Engineers www.scte.org	(800) 542-5040 (610) 363-6888
SDI	Steel Deck Institute www.sdi.org	(847) 458-4647
SDI	Steel Door Institute www.steeldoor.org	(440) 899-0010
SEFA	Scientific Equipment and Furniture Association www.sefalabs.com	(877) 294-5424 (516) 294-5424
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers (See ASCE)	
SIA	Security Industry Association www.siaonline.org	(866) 817-8888 (703) 683-2075
SJI	Steel Joist Institute www.steeljoist.org	(843) 626-1995
SMA	Screen Manufacturers Association www.smacentral.org	(561) 533-0991
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	(703) 803-2980
SMPTE	Society of Motion Picture and Television Engineers www.smpte.org	(914) 761-1100
SPFA	Spray Polyurethane Foam Alliance (Formerly: SPI/SPFD - The Society of the Plastics Industry, Inc.; Spray Polyurethane Foam Division) www.sprayfoam.org	(800) 523-6154
SPIB	Southern Pine Inspection Bureau (The) www.spib.org	(850) 434-2611
SPRI	Single Ply Roofing Industry www.spri.org	(781) 647-7026
SSINA	Specialty Steel Industry of North America www.ssina.com	(800) 982-0355 (202) 342-8630
SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(877) 281-7772 (412) 281-2331

STI	Steel Tank Institute www.steeltank.com	(847) 438-8265
SWI	Steel Window Institute www.steelwindows.com	(216) 241-7333
SWPA	Submersible Wastewater Pump Association www.swpa.org	(847) 681-1868
TCA	Tilt-Up Concrete Association www.tilt-up.org	(319) 895-6911
TCNA	Tile Council of North America, Inc. www.tileusa.com	(864) 646-8453
TEMA	Tubular Exchanger Manufacturers Association www.tema.org	(914) 332-0040
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance www.tiaonline.org	(703) 907-7700
TMS	The Masonry Society www.masonrysociety.org	(303) 939-9700
TPI	Truss Plate Institute, Inc. www.tpinst.org	(703) 683-1010
TPI	Turfgrass Producers International www.turfgrassod.org	(800) 405-8873 (847) 649-5555
TRI	Tile Roofing Institute www.tilerroofing.org	(312) 670-4177
UL	Underwriters Laboratories Inc. www.ul.com	(877) 854-3577 (847) 272-8800
UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902
USAV	USA Volleyball www.usavolleyball.org	(888) 786-5539 (719) 228-6800
USGBC	U.S. Green Building Council www.usgbc.org	(800) 795-1747
USITT	United States Institute for Theatre Technology, Inc. www.usitt.org	(800) 938-7488 (315) 463-6463
WASTEC	Waste Equipment Technology Association www.wastec.org	(800) 424-2869 (202) 244-4700
WCLIB	West Coast Lumber Inspection Bureau www.wclib.org	(800) 283-1486 (503) 639-0651
WCMA	Window Covering Manufacturers Association	(212) 297-2122

www.wcmanet.org

WDMA	Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association) www.wdma.com	(800) 223-2301 (312) 321-6802
WI	Woodwork Institute (Formerly: WIC - Woodwork Institute of California) www.wicnet.org	(916) 372-9943
WMMPA	Wood Moulding & Millwork Producers Association www.wmmpa.com	(800) 550-7889 (530) 661-9591
WSRCA	Western States Roofing Contractors Association www.wsrca.com	(800) 725-0333 (650) 570-5441
WWPA	Western Wood Products Association www.wwpa.org	(503) 224-3930

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

DIN	Deutsches Institut für Normung e.V. www.din.de	49 30 2601-0
IAPMO	International Association of Plumbing and Mechanical Officials www.iapmo.org	(909) 472-4100
ICC	International Code Council www.iccsafe.org	(888) 422-7233
ICC-ES	ICC Evaluation Service, Inc. www.icc-es.org	(800) 423-6587 (562) 699-0543

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

COE	Army Corps of Engineers www.usace.army.mil	(202) 761-0011
CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-7923
DOC	Department of Commerce www.commerce.gov	(202) 482-2000
DOD	Department of Defense http://dodssp.daps.dla.mil	(215) 697-6257

DOE	Department of Energy www.energy.gov	(202) 586-9220
EPA	Environmental Protection Agency www.epa.gov	(202) 272-0167
FAA	Federal Aviation Administration www.faa.gov	(866) 835-5322
FCC	Federal Communications Commission www.fcc.gov	(888) 225-5322
FDA	Food and Drug Administration www.fda.gov	(888) 463-6332
GSA	General Services Administration www.gsa.gov	(800) 488-3111
HUD	Department of Housing and Urban Development www.hud.gov	(202) 708-1112
LBL	Lawrence Berkeley National Laboratory www.lbl.gov	(510) 486-4000
NCHRP	National Cooperative Highway Research Program (See TRB)	
NIST	National Institute of Standards and Technology www.nist.gov	(301) 975-6478
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742 (202) 693-1999
PBS	Public Buildings Service (See GSA)	
PHS	Office of Public Health and Science http://www.hhs.gov/ophs/	(202) 690-7694
RUS	Rural Utilities Service (See USDA)	(202) 720-9540
SD	State Department www.state.gov	(202) 647-4000
TRB	Transportation Research Board http://gulliver.trb.org	(202) 334-2934
USDA	Department of Agriculture www.usda.gov	(202) 720-2791
USP	U.S. Pharmacopeia www.usp.org	(800) 227-8772
USPS	Postal Service www.usps.com	(202) 268-2000

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CBHF	State of California, Department of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation www.dca.ca.gov/bhfti	(800) 952-5210 (916) 574-2041
CCR	California Code of Regulations www.calregs.com	(916) 323-6815
CDHS	California Department of Health Services www.dhcs.ca.gov	(916) 445-4171
CDPH	California Department of Public Health, Indoor Air Quality Section www.cal-iaq.org	
CPUC	California Public Utilities Commission www.cpuc.ca.gov	(415) 703-2782
TFS	Texas Forest Service Forest Resource Development http://txforestservation.tamu.edu	(979) 458-6606

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 01 57 13 – TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings of the Contract, including General and supplementary Conditions and Division 01 Specification Sections, apply to this Section.
 - 1. All temporary erosion and sediment control on the project site.
 - 2. LEED Documentation for certification.

1.2 SUMMARY

- A. This Section includes:
 - 1. Prevention of erosion due to construction activities.
 - 2. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.
 - 3. Restoration of areas eroded due to insufficient preventive measures.
 - 4. Compensation of owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.
- B. Related Sections include the following:
 - 1. Section 31 10 00 – Site Clearing: Limits on clearing: disposition of vegetative clearing debris.
 - 2. Section 31 20 00 – Earth Moving: Preparation and excavation of site for site construction.

1.3 REFERENCE STANDARDS

- A. Illinois Urban Manual, latest edition.
- B. Illinois Department of Transportation, Standard Specifications for Road and Bridge Construction, latest edition.
- C. ASTM D 4355 - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc Type Apparatus.
- D. ASTM D 4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
- E. ASTM D 4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
- F. ASTM D 4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
- G. ASTM D 4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile.

- H. ASTM D 4873 - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples.

1.4 PERFORMANCE REQUIREMENTS

- A. Review the drawings (erosion control notes).
- B. Conduct stormwater pre-construction meeting with construction manager, all ground-disturbing sub-contractors, site engineer of record or their representative who is familiar with the site and state and local agency personnel if available.
- C. Timing: Put preventive measures in place before disturbance of surface cover and before precipitation occurs.
- D. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.
 - 1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.
 - 2. Anticipate runoff volume due to the most extreme short term and 24-hour rainfall events that might occur in 25 years.
- E. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
 - 1. Control movement of sediment and soil from temporary stockpiles of soil.
 - 2. Prevent development of ruts due to equipment and vehicular traffic.
 - 3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to owner.
- F. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.
 - 1. Prevent windblown soil from leaving the project site.
 - 2. Prevent tracking of mud onto public roads outside site.
 - 3. Prevent mud and sediment from flowing onto sidewalks and pavements.
 - 4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to owner.
- G. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
 - 1. If sedimentation occurs, install or correct preventive measures immediately at no cost to owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
 - 2. If sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.
- H. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.

1. If sedimentation occurs, install or correct preventive measures immediately at no cost to owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
- I. Open Water: Prevent standing water that could become stagnant.
- J. Maintenance: Maintain temporary preventive measures until permanent measures have been established.
- K. Prepare all appropriate documentation required by LEED regulations to attain LEED approval.

1.5 SUBMITTALS

- A. Contractor shall submit shop drawings or material certifications for all manufactured erosion and sediment control measures.
- B. Certificate: Mill certificate for silt fence fabric attesting that fabric and factory seams comply with specified requirements, signed by legally authorized official of manufacturer; indicate actual minimum average roll values; identify fabric by roll identification numbers.
- C. Inspection Reports: Submit report of each inspection; identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.
- D. Maintenance Instructions: Provide instructions covering inspection and maintenance for temporary measures that must remain after Substantial Completion.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths:
 1. Average Opening Size: 30 U.S. Std. Sieve, maximum, when tested in accordance with ASTM D 4751.
 2. Permittivity: 0.05 sec^{-1} , minimum, when tested in accordance with ASTM D 4491.
 3. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D 4355 after 500 hours exposure.
 4. Tensile Strength: 100 lb-f, minimum, in cross-machine direction; 124 lb-f, minimum, in machine direction; when tested in accordance with ASTM D 4632.
 5. Elongation: 15 to 30 percent, when tested in accordance with ASTM D 4632.
 6. Tear Strength: 55 lb-f, minimum, when tested in accordance with ASTM D 4533.
 7. Color: Manufacturer's standard, with embedment and fastener lines preprinted.

- B. Silt Fence Posts: One of the following, minimum 5 feet long:
1. Steel U- or T-section, with minimum mass of 1.33 lb per linear foot.
 2. Softwood, 4 by 4 inches in cross section.
 3. Hardwood, 2 by 2 inches in cross section.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.2 PREPARATION

- A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

3.3 SCOPE OF PREVENTIVE MEASURES

- A. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.
- B. Storm Drain Drop Inlet Sediment Traps: As detailed on drawings.
- C. Temporary Splash Pads: Stone aggregate over filter fabric; size to suit application; provide at downspout outlets and storm water outlets.
- E. Soil Stockpiles: Protect using one of the following measures:
1. Cover with polyethylene film, secured by placing soil on outer edges.
 2. Cover with mulch at least 4 inches thickness of pine needles, sawdust, bark, wood chips, or shredded leaves, or 6 inches of straw or hay.

3.4 INSTALLATION

- A. Silt Fences:
1. Store and handle fabric in accordance with ASTM D 4873.
 2. Where slope gradient is less than 3:1 or barriers will be in place less than 6 months, use nominal 16 inch high barriers with minimum 36 inch long posts spaced at 6 feet maximum, with fabric embedded at least 4 inches in ground.
 3. Where slope gradient is steeper than 3:1 or barriers will be in place over 6 months, use nominal 28 inch high barriers, minimum 48 inch long posts spaced at 6 feet maximum, with fabric embedded at least 6 inches in ground.

4. Where slope gradient is steeper than 3:1 and vertical height of slope between barriers is more than 20 feet, use nominal 32 inch high barriers with woven wire reinforcement and steel posts spaced at 4 feet maximum, with fabric embedded at least 6 inches in ground.
5. Install with top of fabric at nominal height and embedment as specified.
6. Embed bottom of fabric in a trench on the upslope side of fence, with 2 inches of fabric laid flat on bottom of trench facing upslope; backfill trench and compact.
7. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches, with extra post.
8. Fasten fabric to wood posts using one of the following:
 - a. Four 3/4 inch diameter, 1 inch long, 14 gage nails.
 - b. Five 17-gage staples with 3/4 inch wide crown and 1/2 inch legs.
9. Fasten fabric to steel posts using wire, nylon cord, or integral pockets.
10. Wherever runoff will flow around end of barrier or over the top, provide temporary splash pad or other outlet protection; at such outlets in the run of the barrier, make barrier not more than 12 inches high with post spacing not more than 4 feet.

3.5 MAINTENANCE

- A. Inspect preventive measures weekly, within 24 hours after the end of any storm that produces 0.5 inches or more rainfall at the project site, and daily during prolonged rainfall.
- B. Repair deficiencies immediately.
- C. Clean out temporary sediment control structures weekly and relocate soil on site.
- D. Place sediment in appropriate locations on site; do not remove from site.

3.6 CLEAN UP

- A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Construction Manager.
- B. Clean out temporary sediment control structures that are to remain as permanent measures.
- C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION 01 57 13

SECTION 01 60 00 - 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 01 23 00 "Alternates" for products selected under an alternate.
 - 2. Section 01 25 00 "Substitution Procedures" for requests for substitutions.
 - 3. Section 01 42 00 "References" for applicable industry standards for products specified.

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 through Construction Manager 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 01 33 00 "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 01 33 00 "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. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 01 77 00 "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 not be considered.
 - 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.
 - 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 01 25 00 "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 01 60 00

SECTION 01 73 00 - 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. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Cutting and patching.
 - 5. Coordination of Owner-installed products.
 - 6. Progress cleaning.
 - 7. Starting and adjusting.
 - 8. Protection of installed construction.
 - 9. Correction of the Work.
- B. Related Requirements:
 - 1. Section 01 33 00 "Submittal Procedures" for submitting surveys.
 - 2. Section 01 77 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
 - 3. Section 02 41 00 "Demolition" for demolition and removal of selected portions of the site and building.

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 INFORMATIONAL SUBMITTALS

- A. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.
- B. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
 3. Products: List products to be used for patching and firms or entities that will perform patching work.
 4. Dates: Indicate when cutting and patching will be performed.
 5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
 - a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.
- C. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- D. Certified Surveys: Submit two copies signed by land surveyor professional engineer.
- E. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.5 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
- B. 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.
- C. 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.
- D. 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. General: Comply with requirements specified in other Sections.
 - 1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with requirements in Section 01 81 13.13 "Sustainable Design Requirements - LEED for New Construction and Major Renovations."
- B. 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 01 31 00 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect and Construction Manager promptly.
- B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
 - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 - 2. Establish limits on use of Project site.
 - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 4. Inform installers of lines and levels to which they must comply.
 - 5. Check the location, level and plumb, of every major element as the Work progresses.
 - 6. Notify Architect and Construction Manager when deviations from required lines and levels exceed allowable tolerances.
 - 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect and Construction Manager.

3.4 FIELD ENGINEERING

- A. Identification: Owner will identify existing benchmarks, control points, and property corners.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect or Construction Manager. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect and Construction Manager before proceeding.
 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.
- E. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
 2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 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 in occupied spaces and 90 inches 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.

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

- F. 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.

- G. 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.
- H. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction personnel.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
 - 1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
 - 2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 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.
 - 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 01 74 19 "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.

3.9 STARTING AND ADJUSTING

- A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 01 91 13 "General Commissioning Requirements."
- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00 "Quality Requirements."

3.10 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 01 73 00

SECTION 01 74 19 - 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 02 41 00 "Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.
 - 2. Section 31 10 00 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

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.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste

management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:

1. Demolition Waste:
 - a. Asphalt paving.
 - b. Concrete.
 - c. Concrete reinforcing steel.
 - d. Brick.
 - e. Concrete masonry units.

2. Construction Waste:
 - a. Masonry and CMU.
 - b. Lumber.
 - c. Wood sheet materials.
 - d. Wood trim.
 - e. Metals.
 - f. Roofing.
 - g. Insulation.
 - h. Carpet and pad.
 - i. Gypsum board.
 - j. Piping.
 - k. Electrical conduit.
 - l. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
 - 1) Paper.
 - 2) Cardboard.
 - 3) Boxes.
 - 4) Plastic sheet and film.
 - 5) Polystyrene packaging.
 - 6) Wood crates.
 - 7) Plastic pails.

1.5 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 30 days of date established for the Notice of Award.

1.6 INFORMATIONAL SUBMITTALS

- A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:
 1. Material category.
 2. Generation point of waste.
 3. Total quantity of waste in tons.
 4. Quantity of waste salvaged, both estimated and actual in tons.
 5. Quantity of waste recycled, both estimated and actual in tons.
 6. Total quantity of waste recovered (salvaged plus recycled) in tons.

7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- F. Landfill 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.
- G. LEED Submittal: LEED letter template for Credit MR 2, signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.
- H. Qualification Data: For waste management coordinator.

1.7 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: Experienced firm, with a record of successful waste management coordination of projects with similar requirements, that employs a LEED-Accredited Professional, certified by the USGBC, as waste management coordinator.
- B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Waste Management Conference: Conduct conference at Project site. Review methods and procedures related to waste management including, but not limited to, the following:
 1. Review and discuss waste management plan including responsibilities of waste management coordinator.
 2. Review requirements for documenting quantities of each type of waste and its disposition.
 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 5. Review waste management requirements for each trade.

1.8 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
 - 1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
 - 2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
 - 3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
 - 4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 - 5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 - 6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

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 CM Requirements for "Temporary Facilities and Controls."
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.

- C. 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.

- D. 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 CM Requirements for "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 Owner.

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

3.3 RECYCLING DEMOLITION WASTE

- A. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.
 - 1. Asphalt Paving may not be used as general fill.
- B. Concrete: Break up and transport concrete to concrete-recycling facility.
 - 1. Concrete may not be used as general and subbase fill.
- C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

3.4 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
 - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 - 2. Polystyrene Packaging: Separate and bag materials.
 - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Wood Materials:
 - 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
 - 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
- C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

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 01 74 19

SECTION 01 77 00 - 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. Repair of the Work.
- B. Related Requirements:
 - 1. Section 01 73 00 "Execution" for progress cleaning of Project site.
 - 2. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 3. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 4. Section 01 79 00 "Demonstration and Training" for requirements for instructing Owner's personnel.

1.3 ACTION SUBMITTALS

- A. Product Data: For cleaning agents.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. 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 Construction Manager. 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 Construction Manager's signature for receipt of submittals.
 - 5. Submit test/adjust/balance records.
 - 6. Submit sustainable design submittals required in Section 01 81 13.13 "Sustainable Design Requirements - LEED for New Construction and Major Renovations."
 - 7. 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. Submit demonstration and training video recordings specified in Section 01 79 00 "Demonstration and Training."
 - 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 and Construction Manager 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 Construction Manager's 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.
- 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 and Construction Manager 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. Use CSI Form 14.1A or similar.
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 and Construction Manager.
 - d. Name of Contractor.
 - e. Page number.
 4. Submit list of incomplete items in the following format:
 - a. MS Excel electronic file. Architect, through Construction Manager, 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 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.
 - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 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 01 77 00

SECTION 01 78 23 - 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. Operation and maintenance documentation directory.
 - 2. Emergency manuals.
 - 3. Operation manuals for systems, subsystems, and equipment.
 - 4. Product maintenance manuals.
- B. Related Requirements:
 - 1. Section 01 33 00 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
 - 2. Section 01 91 13 "General Commissioning Requirements" for verification and compilation of data into 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 and Commissioning Authority 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. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect and Commissioning Authority will comment on whether general scope and content of manual are acceptable.
- D. 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 and Commissioning Authority will return copy with comments.
 - 1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
 - 1. List of documents.
 - 2. List of systems.
 - 3. List of equipment.
 - 4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 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.

2.3 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
1. Type of emergency.
 2. Emergency instructions.
 3. Emergency procedures.

- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
1. Fire.
 2. Flood.
 3. Gas leak.
 4. Water leak.
 5. Power failure.
 6. Water outage.
 7. System, subsystem, or equipment failure.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
 2. Shutdown instructions for each type of emergency.
 3. Operating instructions for conditions outside normal operating limits.
 4. Required sequences for electric or electronic systems.
 5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 2. Performance and design criteria if Contractor has delegated design responsibility.
 3. Operating standards.
 4. Operating procedures.
 5. Operating logs.
 6. Wiring diagrams.
 7. Control diagrams.
 8. Piped system diagrams.
 9. Precautions against improper use.
 10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
 2. Manufacturer's name.
 3. Equipment identification with serial number of each component.
 4. Equipment function.
 5. Operating characteristics.
 6. Limiting conditions.
 7. Performance curves.
 8. Engineering data and tests.

9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
 2. Equipment or system break-in procedures.
 3. Routine and normal operating instructions.
 4. Regulation and control procedures.
 5. Instructions on stopping.
 6. Normal shutdown instructions.
 7. Seasonal and weekend operating instructions.
 8. Required sequences for electric or electronic systems.
 9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 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.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
- B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- D. 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.
- E. 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.
- F. 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 01 78 39 "Project Record Documents."
- G. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 78 23

SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
- B. Related Requirements:
 - 1. Section 01 73 00 "Execution" for final property survey.
 - 2. Section 01 77 00 "Closeout Procedures" for general closeout procedures.
 - 3. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit copies of record Drawings as follows:
 - a. Initial Submittal:
 - 1) Submit PDF electronic files of scanned record prints and one of file prints.
 - 2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - 1) Submit PDF electronic files of scanned record prints and three set(s) of prints.
 - 2) 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.

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.
 - e. Cross-reference record prints to corresponding archive photographic documentation.
 - 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations below first floor.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Change Directive.
 - k. Changes made following Architect's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.
 - 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 - 4. Mark record 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. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect and Construction Manager.
 - e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
 5. Note related Change Orders, record Product Data, and record Drawings where applicable.
- B. Format: Submit record Specifications as annotated PDF electronic file or scanned PDF electronic file(s) of marked-up paper copy of Specifications.

2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 3. Note related Change Orders, record Specifications, and record Drawings where applicable.
- B. Format: Submit record Product Data as annotated PDF electronic file or scanned PDF electronic file(s) of marked-up paper copy of Product Data.
1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

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 and Construction Manager's reference during normal working hours.

END OF SECTION 01 78 39

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

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 instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.

1.3 QUALITY ASSURANCE

- A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 40 00 "Quality Requirements," experienced in operation and maintenance procedures and training.
- B. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
 - 1. Inspect and discuss locations and other facilities required for instruction.
 - 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
 - 3. Review required content of instruction.
 - 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.4 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 - 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Operations manuals.
 - c. Maintenance manuals.
 - d. Project record documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. Maintenance service agreements and similar continuing commitments.
 - 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
 - 4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.

- e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
- a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
6. Maintenance: Include the following:
- a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 78 23 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

- A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Owner will furnish Contractor with names and positions of participants.
- B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner, through Construction Manager, with at least seven days' advance notice.
- C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final

operation and maintenance data submittals.

- D. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 01 79 00

SECTION 01 81 13.13 - SUSTAINABLE DESIGN REQUIREMENTS - LEED FOR NEW CONSTRUCTION AND MAJOR RENOVATIONS

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 requirements and procedures for compliance with certain USGBC LEED prerequisites and credits needed for Project to obtain LEED Silver certification based on USGBC's "LEED 2009 for New Construction & Major Renovations."
 - 1. Other LEED prerequisites and credits needed to obtain LEED certification depend on product selections and may not be specifically identified as LEED requirements. Compliance with requirements needed to obtain LEED prerequisites and credits may be used as one criterion to evaluate substitution requests and comparable product requests.
 - 2. Additional LEED prerequisites and credits needed to obtain the indicated LEED certification depend on Architect's design and other aspects of Project that are not part of the Work of the Contract.
 - 3. A copy of the LEED Project checklist is attached at the end of this Section for information only.
 - 4. Specific requirements for LEED are included in greater detail in other Sections.

1.3 DEFINITIONS

- A. Chain-of-Custody Certificates: Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship." Certificates shall include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
- B. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
- C. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
 - 1. "Post-consumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 - 2. "Pre-consumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials such as

rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Respond to questions and requests from Architect and the USGBC regarding LEED credits that are the responsibility of the Contractor, that depend on product selection or product qualities, or that depend on Contractor's procedures until the USGBC has made its determination on the project's LEED certification application. Document responses as informational submittals.

1.5 ACTION SUBMITTALS

- A. General: Submit additional LEED submittals required by other Specification Sections.
- B. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.
- C. LEED Documentation Submittals:
 - 1. Credit MR 2: Comply with Section 01 74 19 "Construction Waste Management and Disposal."
 - 2. Credit MR 4: Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating cost for each product having recycled content.
 - 3. Credit MR 5: Product data for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 - 4. Credit MR 7: Product data and chain-of-custody certificates for products containing certified wood. Include statement indicating cost for each certified wood product.
 - 5. Credit EQ 3.1:
 - a. Construction indoor-air-quality management plan.
 - b. Product data for temporary filtration media.
 - c. Product data for filtration media used during occupancy.
 - d. Construction Documentation: Six photographs at three different times during the construction period, along with a brief description of the SMACNA approach employed, documenting implementation of the indoor-air-quality management measures, such as protection of ducts and on-site stored or installed absorptive materials.
 - 6. Credit IEQ 3.2:
 - a. Signed statement describing the building air flush-out procedures including the dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.
 - b. Product data for filtration media used during flush-out and during occupancy.

- c. Report from testing and inspecting agency indicating results of indoor-air-quality testing and documentation showing compliance with indoor-air-quality testing procedures and requirements.
- 7. Credit IEQ 4.1: Product data for adhesives and sealants used inside the weatherproofing system indicating VOC content of each product used.
- 8. Credit IEQ 4.2: Product data for paints and coatings used inside the weatherproofing system indicating VOC content of each product used.
- 9. Credit IEQ 4.4: Product data for products containing composite wood or agrifiber products or wood glues indicating that they do not contain urea-formaldehyde resin.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For LEED coordinator.
- B. Project Materials Cost Data: Provide statement indicating total cost for materials used for Project. Costs exclude labor, overhead, and profit. Include breakout of costs for the following categories of items:
 - 1. Furniture.
 - 2. Plumbing.
 - 3. Mechanical.
 - 4. Electrical.
 - 5. Specialty items such as elevators and equipment.
 - 6. Wood-based construction materials.
- C. LEED Action Plans: Provide preliminary submittals within 30 days of date established for the Notice of Award indicating how the following requirements will be met:
 - 1. Credit MR 2: Waste management plan complying with Section 01 74 19 "Construction Waste Management and Disposal."
 - 2. Credit MR 4: List of proposed materials with recycled content. Indicate cost, post-consumer recycled content, and pre-consumer recycled content for each product having recycled content.
 - 3. Credit MR 5: List of proposed regional materials. Identify each regional material, including its source, cost, and the fraction by weight that is considered regional.
 - 4. Credit MR 7: List of proposed certified wood products. Indicate each product containing certified wood, including its source and cost of certified wood products.
 - 5. Credit IEQ 3.1: Construction indoor-air-quality management plan.
- D. LEED Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with LEED action plans for the following:
 - 1. Credit MR 2: Waste reduction progress reports complying with Section 01 74 19 "Construction Waste Management and Disposal."
 - 2. Credit MR 3: Salvaged, refurbished, and reused materials.
 - 3. Credit MR 4: Recycled content.
 - 4. Credit MR 5: Regional materials.
 - 5. Credit MR 7: Certified wood products.

1.7 QUALITY ASSURANCE

- A. LEED Coordinator: Engage an experienced LEED-Accredited Professional to coordinate LEED requirements. LEED coordinator may also serve as waste management coordinator.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Provide products and procedures necessary to obtain LEED credits required in this Section. Although other Sections may specify some requirements that contribute to LEED credits, the Contractor shall determine additional materials and procedures necessary to obtain LEED credits indicated.

2.2 RECYCLED CONTENT OF MATERIALS

- A. Credit MR 4: Building materials shall have recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content for Project constitutes a minimum of 20 percent of cost of materials used for Project.
 - 1. Cost of post-consumer recycled content plus one-half of pre-consumer recycled content of an item shall be determined by dividing weight of post-consumer recycled content plus one-half of pre-consumer recycled content in the item by total weight of the item and multiplying by cost of the item.
 - 2. Do not include furniture, plumbing, mechanical and electrical components, and specialty items such as elevators and equipment in the calculation.

2.3 REGIONAL MATERIALS

- A. Credit MR 5: Not less than 20 percent of building materials (by cost) shall be regional materials.

2.4 CERTIFIED WOOD (ALTERNATE BID)

- A. Credit MR 7: Not less than 50 percent (by cost) of wood-based materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
 - 1. Wood-based materials include, but are not limited to, the following materials when made from wood, engineered wood products, or wood-based panel products:
 - a. Rough carpentry.
 - b. Miscellaneous carpentry.
 - c. Heavy timber construction.
 - d. Wood decking.

- e. Metal-plate-connected wood trusses.
- f. Structural glued-laminated timber.
- g. Finish carpentry.
- h. Architectural woodwork.
- i. Wood paneling.
- j. Wood veneer wall covering.
- k. Wood flooring.
- l. Wood lockers.
- m. Wood cabinets.
- n. Furniture.

2.5 LOW-EMITTING MATERIALS

A. Credit IEQ 4.1: For field applications that are inside the weatherproofing system, adhesives and sealants shall comply with the following VOC content limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

- 1. Wood Glues: 30 g/L.
- 2. Metal-to-Metal Adhesives: 30 g/L.
- 3. Adhesives for Porous Materials (Except Wood): 50 g/L.
- 4. Subfloor Adhesives: 50 g/L.
- 5. Plastic Foam Adhesives: 50 g/L.
- 6. Carpet Adhesives: 50 g/L.
- 7. Carpet Pad Adhesives: 50 g/L.
- 8. VCT and Asphalt Tile Adhesives: 50 g/L.
- 9. Cove Base Adhesives: 50 g/L.
- 10. Gypsum Board and Panel Adhesives: 50 g/L.
- 11. Rubber Floor Adhesives: 60 g/L.
- 12. Ceramic Tile Adhesives: 65 g/L.
- 13. Multipurpose Construction Adhesives: 70 g/L.
- 14. Fiberglass Adhesives: 80 g/L.
- 15. Contact Adhesive: 80 g/L.
- 16. Structural Glazing Adhesives: 100 g/L.
- 17. Wood Flooring Adhesive: 100 g/L.
- 18. Structural Wood Member Adhesive: 140 g/L.
- 19. Single-Ply Roof Membrane Adhesive: 250 g/L.
- 20. Special-Purpose Contact Adhesive (contact adhesive that is used to bond melamine-covered board, metal, unsupported vinyl, rubber, or wood veneer 1/16 inch or less in thickness to any surface): 250 g/L.
- 21. Top and Trim Adhesive: 250 g/L.
- 22. Plastic Cement Welding Compounds: 250 g/L.
- 23. ABS Welding Compounds: 325 g/L.
- 24. CPVC Welding Compounds: 490 g/L.
- 25. PVC Welding Compounds: 510 g/L.
- 26. Adhesive Primer for Plastic: 550 g/L.
- 27. Sheet-Applied Rubber Lining Adhesive: 850 g/L.
- 28. Aerosol Adhesive, General-Purpose Mist Spray: 65 percent by weight.
- 29. Aerosol Adhesive, General-Purpose Web Spray: 55 percent by weight.
- 30. Special-Purpose Aerosol Adhesive (All Types): 70 percent by weight.
- 31. Other Adhesives: 250 g/L.
- 32. Architectural Sealants: 250 g/L.
- 33. Nonmembrane Roof Sealants: 300 g/L.
- 34. Single-Ply Roof Membrane Sealants: 450 g/L.
- 35. Other Sealants: 420 g/L.

- 36. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 37. Sealant Primers for Porous Substrates: 775 g/L.
 - 38. Modified Bituminous Sealant Primers: 500 g/L.
 - 39. Other Sealant Primers: 750 g/L.
- B. Credit IEQ 4.2: For field applications that are inside the weatherproofing system, paints and coatings shall comply with the following VOC content limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
- 1. Flat Paints and Coatings: VOC not more than 50 g/L.
 - 2. Nonflat Paints and Coatings: VOC not more than 150 g/L.
 - 3. Dry-Fog Coatings: VOC not more than 400 g/L.
 - 4. Primers, Sealers, and Undercoaters: VOC not more than 200 g/L.
 - 5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
 - 6. Zinc-Rich Industrial Maintenance Primers: VOC not more than 340 g/L.
 - 7. Pretreatment Wash Primers: VOC not more than 420 g/L.
 - 8. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
 - 9. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
 - 10. Floor Coatings: VOC not more than 100 g/L.
 - 11. Shellacs, Clear: VOC not more than 730 g/L.
 - 12. Shellacs, Pigmented: VOC not more than 550 g/L.
 - 13. Stains: VOC not more than 250 g/L.
- C. Credit IEQ 4.4: Composite wood, agrifiber products, and adhesives shall not contain urea-formaldehyde resin.

PART 3 - EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT

- A. Credit MR 2: Comply with Section 01 74 19 "Construction Waste Management and Disposal."

3.2 CONSTRUCTION INDOOR-AIR-QUALITY MANAGEMENT

- A. Credit IEQ 3.1: Comply with SMACNA's "SMACNA IAQ Guideline for Occupied Buildings under Construction."
 - 1. If Owner authorizes use of permanent heating, cooling, and ventilating systems during construction period as specified in Section 01 50 00 "Temporary Facilities and Controls," install filter media having a MERV 8 according to ASHRAE 52.2 at each return-air inlet for the air-handling system used during construction.
 - 2. Replace all air filters immediately prior to occupancy.
- B. Credit IEQ 3.2: Comply with one of the following requirements:
 - 1. After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total volume of 14000 cu. ft. of outdoor air per sq. ft. of floor area while maintaining an internal temperature of at least 60 deg F and a relative humidity no higher than 60 percent.
 - 2. If occupancy is desired prior to flush-out completion, the space may be occupied

following delivery of a minimum of 3500 cu. ft. of outdoor air per sq. ft. of floor area to the space. Once a space is occupied, it shall be ventilated at a minimum rate of 0.30 cfm per sq. ft. of outside air or the design minimum outside air rate determined in Prerequisite EQ 1, whichever is greater. During each day of the flush-out period, ventilation shall begin a minimum of three hours prior to occupancy and continue during occupancy. These conditions shall be maintained until a total of 14000 cu. ft./sq. ft. of outside air has been delivered to the space.

3. Air-Quality Testing:

- a. Conduct baseline indoor-air-quality testing, after construction ends and prior to occupancy, using testing protocols consistent with the EPA's "Compendium of Methods for the Determination of Air Pollutants in Indoor Air," and as additionally detailed in the USGBC's "Green Building Design and Construction Reference Guide."
- b. Demonstrate that the contaminant maximum concentrations listed below are not exceeded:
 - 1) Formaldehyde: 27 ppb.
 - 2) Particulates (PM10): 50 micrograms/cu. m.
 - 3) Total Volatile Organic Compounds (TVOC): 500 micrograms/cu. m.
 - 4) 4-Phenylcyclohexene (4-PH): 6.5 micrograms/cu. m.
 - 5) Carbon Monoxide: 9 ppm and no greater than 2 ppm above outdoor levels.
- c. For each sampling point where the maximum concentration limits are exceeded, conduct additional flush-out with outside air and retest the specific parameter(s) exceeded to indicate the requirements are achieved. Repeat procedure until all requirements have been met. When retesting noncomplying building areas, take samples from same locations as in the first test.
- d. Air-sample testing shall be conducted as follows:
 - 1) All measurements shall be conducted prior to occupancy but during normal occupied hours, and with building ventilation system starting at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the duration of the air testing.
 - 2) Building shall have all interior finishes installed including, but not limited to, millwork, doors, paint, carpet, and acoustic tiles. Nonfixed furnishings such as workstations and partitions are encouraged, but not required, to be in place for the testing.
 - 3) Number of sampling locations varies depending on the size of building and number of ventilation systems. For each portion of building served by a separate ventilation system, the number of sampling points shall not be less than one per 25,000 sq. ft. or for each contiguous floor area, whichever is larger, and shall include areas with the least ventilation and greatest presumed source strength.
 - 4) Air samples shall be collected between 3 and 6 feet from the floor to represent the breathing zone of occupants, and over a minimum four-hour period.

END OF SECTION 01 81 13.13

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40	11	10	46	Total Project Score
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Certified 40 points **Silver** 50 points **Gold** 60 points **Platinum** 80 or more points

Probable	Medium	Low	Not Likely				
7	7	2	13	Sustainable Sites	Possible Points	26	
Y				Prereq 1	Erosion & Sedimentation Control		D & C
	2			Credit 1	Site Selection	1	D
			5	Credit 2	Development Density & Community Connectivity	5	D
			1	Credit 3	Brownfield Redevelopment	1	D
			6	Credit 4.1	Altern Transportation, Public Transportation Access	6	D
			1	Credit 4.2	Altern Transportation, Bicycle Storage & Changing Rooms	1	D
3				Credit 4.3	Altern Transportation, Low Emission	3	D
2				Credit 4.4	Altern Transportation, Parking Capacity	2	D
	2			Credit 5.1	Protect or Restore Habitat	1	D & C
		1		Credit 5.2	Maximize Open Space	1	D
		1		Credit 6.1	Stormwater Management, Quantity Control	1	D
	2			Credit 6.2	Stormwater Management, Quality Control	1	D
1				Credit 7.1	Reduce Heat Islands, Site / Non-Roof	1	C
1				Credit 7.2	Reduce Heat Islands, Roof	1	C
	1			Credit 8	Light Pollution Reduction	1	D

7			4	Water Efficiency	Possible Points	10	
Y				Prereq 1	Water Use Reduction		D
5				Credit 1.1	Water Efficient Landscaping	4	D
			2	Credit 2	Wastewater Technologies	2	D
2			2	Credit 3	Water Use Reduction	4	D

6	2	6	21	Energy & Atmosphere	Possible Points	35	
Y				Prereq 1	Fundamental Building Systems Commissioning		C
Y				Prereq 2	Minimum Energy Performance		D
Y				Prereq 3	Fundamental Refrigerant Management		D
1	2		16	Credit 1.5	Optimize Energy Performance,	19	D
		2	5	Credit 2.1	Renewable Energy	7	D
		2		Credit 3	Enhanced Commissioning	2	C
2				Credit 4	Enhanced Refrigerant Management	2	D
1	2			Credit 5	Measurement & Verification	3	C
2				Credit 6	Green Power	2	C

6		1	4	Materials & Resources	Possible Points	14	
Y				Prereq 1	Storage & Collection of Recyclables		D
			1	Credit 1.1	Building Reuse, Existing Shell and Structure	3	C
			1	Credit 1.3	Building Reuse, Maintain 100% Shell & 50% Non-Shell	1	C
2				Credit 2.1	Construction Waste Management	2	C
			1	Credit 3.1	Material Reuse	2	C
2				Credit 4.1	Recycled Content	2	C
2				Credit 5.1	Local/Regional Materials	2	C
			1	Credit 6	Rapidly Renewable Materials	1	C
		1		Credit 7	Certified Wood	1	C

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9	1	1	4	Indoor Environmental Quality	Possible Points	15
Y				Prereq 1 Minimum IAQ Performance		D
Y				Prereq 2 Environmental Tobacco Smoke Control		D
1				Credit 1 Carbon Dioxide (CO₂) Monitoring	1	D
			1	Credit 2 Increase Ventilation Quantity	1	D
1				Credit 3.1 IAQ Management Plan , During Construction	1	C
1				Credit 3.2 IAQ Management Plan , Before Occupancy	1	C
1				Credit 4.1 Low-Emitting Materials , Adhesives & Sealants	1	C
1				Credit 4.2 Low-Emitting Materials , Paints	1	C
1				Credit 4.3 Low-Emitting Materials , Flooring	1	C
1				Credit 4.4 Low-Emitting Materials , Composite Wood	1	C
1				Credit 5 Indoor Chemical & Pollutant Source Control	1	D
			1	Credit 6.1 Controllability of Systems , Lighting Controls 90% spaces	1	D
	1			Credit 6.2 Controllability of Systems , Thermal Controls	1	D
1				Credit 7.1 Thermal Comfort , Comply with ASHRAE 55-1992	1	D
		1		Credit 7.2 Thermal Comfort , Assessment	1	C
			1	Credit 8.1 Daylight , 75% of Spaces	1	D
			1	Credit 8.2 Views , 90% of Spaces	1	D

5	1			Innovation & Design Process	Possible Points	5
1				Credit 1.1 Innovation Design : Green Education	1	
1				Credit 1.2 Innovation Design : Green Power	1	
1				Credit 1.3 Innovation Design : Increased Recycled Content	1	
	1			Credit 1.4 Innovation Design : Pest Control	1	
1				Credit 1.5 Innovation Design : Green Cleaning	1	
1				Credit 2 LEED™ Accredited Professional	1	

SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifically identifies the requirements of the Project Commissioning Team, which includes the Commissioning Provider (CxP), Owner, General Contractor, Installation Contractors, Equipment Suppliers and Vendors in the execution of the commissioning process. A Commissioning Plan shall be provided by the CxP early in the Construction Phase to outline the Commissioning Process, including roles and responsibilities of the Project Commissioning Team. The plan shall also identify the logistics, schedules and management protocols associated with the commissioning process. The plan shall be updated by the CxP as required to accommodate project logistical changes.
- B. This Section shall delineate the requirements of the GC and Installation Contractors for the execution of the commissioning process for the following activities:
1. Participation in Commissioning Meetings
 2. Commissioning submittal requirements
 3. Installation verification and start-up for system components.
 4. Functional operational demonstration of system performance
 5. Commissioning field deficiencies and test deficiencies.
 6. The GC and Installation Contractors shall:
 - a. Verify installation and perform quality control.
 - b. Provide project scheduling that coordinates commissioning activities with installation contractors' activities
 - c. Execute the Training Plan
 - d. Perform equipment installation verification and start up. Contractor shall verify the functional readiness of systems to be tested, using pre-functional performance tests, prior to scheduling and demonstrating the functional operational performance in the presence of the CxP.
 - e. Conduct functional performance testing
 - f. Correct deficiencies
 - g. Conduct functional performance retesting, as necessary
 - h. Provide documentation of the effort.
- C. The Owner, Architect/Engineer, and CxP are not responsible for construction means, methods, job safety, or management function related to commissioning on the job site.

1.2 RELATED SECTIONS

- A. Section 01 91 14 – Functional Testing Requirements
- B. Division 14 – Conveying Equipment
- C. Division 21 – Fire Protection
- D. Division 22 – Plumbing
- E. Division 23 – Heating, Ventilation and Air Conditioning
- F. Division 26 – Electrical
- G. Division 28 – Electronic Safety and Security

1.3 EQUIPMENT AND SYSTEMS INCLUDED IN COMMISSIONING PROGRAM

- A. The following is a list of the equipment and system test requirements included in this section:
1. Division 14 – Conveying Equipment
 - a. Elevators
 2. Division 21 – Fire Protection
 - a. Fire Protection System
 3. Division 22 - Plumbing
 - a. Sump Systems
 - b. Water Supply Including Circulation Systems & Auto Valves
 4. Division 23 - Heating Ventilating and Air Conditioning
 - a. Rooftop Unit With DX Cooling
 - b. Computer Room Air Conditioning Units
 - c. Variable Air Volume Boxes
 - d. Fan Coil Units
 - e. Cabinet Heaters
 - f. Unit Heaters
 - g. Toilet Exhaust
 - h. Gas Fired Rooftop Units
 - i. Boilers
 - j. DDC Building Control System (HVAC System, Security Systems & Emergency Power)
 5. Division 26 - Electrical
 - a. Lighting Control Including Time Settings & Sensitivity on Sensors
 - b. Power Monitoring & Control
 - c. Variable Frequency Drives
 - d. Electrical Distribution, Greater Than 400A
 - e. Automatic Transfer Switches
 6. Division 28 – Electronic Safety
 - a. Fire Alarm System

1.4 DEFINITIONS

- A. Acceptance Phase: Phase of construction after startup and initial checkout when Functional Performance Testing, O&M documentation review, and facility and user training occur.
- B. Basis of Design (BOD): Documentation of design criteria and decisions made to meet design intent. Describes systems, components, conditions, and methods chosen to define the intent of the Owner.
- C. Building Automation System (BAS): The system used to control building system in accordance with specifies sequenced of operation.
- D. Commissioning Plan (CP): A manual providing documentation of roles and responsibilities and provides structured means of scheduling, coordination and documentation for the commissioning process.
- E. Commissioning Provider (CxP): The consultant who facilitates the commissioning program and directs and coordinates day-to-day commissioning activities. Acts as the objective advocate for the Owner. The CxP is contracted by the Owner.
- F. Commissioning Team (CT): The Project Team including the Owner, General Contractor, Design Professional, Installation Contractors and equipment manufacturer representatives (as needed).

- G. Deferred Functional Test: Functional performance test performed after substantial completion due to conditions that preclude test from being performed in normal sequential order of project delivery. Also includes seasonal testing of environmental systems.
- H. Deficiency: Condition of a component, piece of equipment, or system that is not in compliance with Contract Documents. The CxP shall conduct a series of construction phase site visits to observe the progress of installation of building systems in the Commissioning Program. Deficiencies identified by the CxP shall be reviewed by the Design Professionals to determine if the deficiency is a non-conformance issue. If the issue is a non-conformance issue, the Design Professionals shall include the issue in their non-conforming issues report to the contractors.
- I. Design Professional (A/E): The design team, generally the Architect, Mechanical Engineer and Electrical Engineer.
- J. Factory Testing: Testing of equipment at factory by the Manufacturer.
- K. Functional Performance Test (FPT): Test of dynamic function and operation of equipment and systems. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. Systems are run through all specified sequences of operation. Components are verified to be responding in accordance with contract documents. Functional Performance Tests are witnessed by the CxP and executed by the responsible contractor after installation certification forms and start-ups and Pre-Functional Test documentation.
- L. Functional Performance Test Document: Protocols and instructions provided for and described in the Commissioning Plan and specifications that describe process required to document Functionality Testing process for each system. Also includes the Systems Integration Tests to confirm that various inter-related systems respond as intended. . CxP develops Functional Performance Test procedures in sequential written form, coordinates, oversees and documents actual testing, which is usually performed by installing contractor or vendor.
- M. General Contractor (GC): The prime contractor responsible for the construction of the facility in accordance with contract documents. Responsible for oversight and coordination of all sub-contractor activities to ensure on-time project delivery and compliance with the commissioning program.
- N. Installation Certification Form (ICF): Document used by the GC to certify that they have inspected the work of the installing contractors and determined that it is in full compliance with the contract requirements. This form is required on each piece of equipment or component prior to functionally testing the system. Monitoring: Recording of parameters (flow, current, status, pressure, etc.) of equipment operation using data loggers or trending capabilities of control systems.
- O. Installation Contractor (Sub-Contractor): Contractor who is under contract to General Contractor who provides and/or installs building components and systems.
- P. Phased Commissioning: Commissioning completed in phases due to size of structure, construction phasing, availability of systems, etc.
- Q. Pre-Functional Testing (PFT): Testing performed by the responsible contractor utilizing the functional performance test protocol This testing is a prerequisite to the Functional Performance Test witnessed and documented by the CxP.
- R. Seasonal Performance Evaluation: Functional Performance evaluation executed at the time of year such that system(s) experience conditions closer to design conditions. Includes a combination of trend log analysis and possibly on-site testing as appropriate.
- S. Specifications: Construction specifications of Contract Documents.

- T. Startup: Initial start or activation of dynamic equipment, including executing the Installation Certification Form and completing a manufacturer's start-up and form where applicable.
- U. Trending: Monitoring controls points of systems as a function of time using building control system.
- V. Vendor: Supplier of equipment.

1.5 COORDINATION

- A. Perform commissioning services to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures.
- B. CxP shall provide overall coordination and management of the commissioning program as specified herein.
- C. Commissioning Team:
 - 1. The Commissioning Team (CT) is comprised of representatives from the project team who shall be the primary contact for commissioning activities:
 - a. Commissioning Provider (CxP)
 - b. Owner's Representative(s) (OR)
 - c. General Contractor
 - d. Design Professional (A/E)
 - e. Finishes Contractors
 - f. Equipment Installation Contractors
 - g. Mechanical Contractor (MC)
 - h. Electrical Contractor (EC)
 - i. Test and Balance Contractor (TAB)
 - j. Controls Contractor (CC)
 - k. Equipment Suppliers and Vendors
- D. The CxP may witness test activities specified in Division 1 and the technical specifications as well as select construction tests (e.g. piping pressure tests, duct leakage test, etc.) and equipment start-up tests. The OR shall witness commissioning activities as appropriate. Contractors shall provide a minimum five (5) working days advanced notice when tests are scheduled.
- E. Contractor shall provide written timely notice to GC and CxP of any changes in date, time, and location or anticipated duration of start-up and test activities. For the purpose of this paragraph written notice shall be received by a minimum of 48 hours in advance to be considered timely.
- F. Tests that are not performed as scheduled shall be considered a failed test unless notification of cancellation or rescheduling was received by all parties. The notification shall be received 48 hours prior to the scheduled arrival of the CxP on site to witness functional testing. Contractor shall reimburse Owner for actual costs incurred by the Owner as the result of failure to provide timely notice, per preceding paragraph, of changes in date, time, location, or anticipated duration of start-up and test activities. The actual costs incurred by the Owner shall include costs associated with the CxP involvement.
- G. Meeting:
 - 1. Within 90 days after all installation contractors involved in the commissioning program have been awarded a contract for the project, the CxP shall plan, schedule, and conduct a commissioning kickoff meeting with designated project team commissioning representatives in attendance. Responsibilities of the commissioning team shall be clarified at this meeting. The CxP shall distribute meeting minutes to all parties.

2. Commissioning meetings shall be held on a monthly basis as a minimum during the construction installation phase of work. The frequency of these meetings shall increase as construction and acceptance activities require. Designated project team commissioning representatives shall attend the meetings as appropriate based upon the agenda topics to be discussed.
3. Commissioning meetings shall be held weekly during the functional performance testing phase to review status of testing discrepancies and scheduling of retests and back checks.

H. Scheduling:

1. Once a master construction schedule is issued, the CxP shall provide for incorporation to the schedule, commissioning milestone activities linked to specific predecessor construction activities. As construction progresses, more specific activities and milestones shall be incorporated into the master construction schedule.
2. Approximately 6 to 8 weeks prior to the commencement of equipment start-ups, the CxP shall conduct a commissioning functional testing schedule workshop with all commissioning representatives. The purpose of this workshop is to establish a coordinated approach to the integration of the function testing activities with the master construction schedule to ensure substantial completion can be achieved as scheduled.
3. In cooperation with the CxP, the GC shall integrate commissioning activities into the master construction schedule.
4. Scheduling issues shall be resolved at monthly commissioning meetings.

1.6 SUBMITTALS

- A. General: Submit the following in accordance with requirements of Section 01 33 00.
- B. Start-up plan: For each piece of equipment or system, the GC and Installation Contractors shall submit a start-up plan. Obtain approval of the plan prior to beginning activities. The plan should include, but not be limited to, the following:
 1. Start-up schedule
 2. Names of firms/individuals required to participate
 3. Detailed manufacturer start-up procedures
 4. Manufacturer start-up data forms
- C. Installation Certification Form (ICF): Installation contractors shall provide CxP, through the GC a completed ICF and a completed manufacturer's start-up form for each piece of equipment or component of a building system included in the commissioning program. These documents shall be used to determine the readiness of the building system for functional performance testing.
- D. Pre-Functional Performance Test Documentation: Responsible contractor shall execute the pre-functional performance test and document the satisfactory results of the testing. The completed test shall be provided to the CxP through the GC for review and approval. Final scheduling of the functional performance test on a building system shall not be established until the pre-functional performance test documentation is approved.
- E. Temporary Use of Permanent Equipment Operations and Maintenance Plan: Should the contractor receive authorization from the OR to utilize permanent equipment per Section 01 9113-3.2, an Operations and Maintenance Plan shall be submitted for review and approval prior to temporary use of permanent equipment. The Plan shall include a temporary sequence of operations.
- F. Submit the final program logic and as-built control sequences used to control all systems included in the commissioning program. As-built control sequences shall also include all system setpoints and reset schedules.
- G. The CxP shall review submittals for criteria as related to commissioning. Review is primarily intended to aid in development of functional testing procedures and secondarily to verify

compliance with equipment specifications. The CxP notifies the GC, OR and A/E of missing items or where issues may exist.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. Installation contractors shall provide all specialized tools, test equipment, and instruments required to execute startup, checkout, field calibration and functional performance testing of equipment under their contract.
- B. Test equipment shall be of sufficient quality and accuracy (greater accuracy than specified for component) to test and/or measure system performance according to specified tolerances. Test equipment is to have been calibrated within the previous 12 months. Calibration shall be NIST traceable. Equipment shall be re-calibrated when dropped or damaged. Calibration tags shall be affixed or certificates be readily available for review by the CxP.
- C. Datalogging equipment or software required to test equipment will be provided by the CxP, but shall not become the property of the Owner.

PART 3 - EXECUTION

3.1 COMMISSIONING OVERVIEW

- A. The following provides a brief overview of typical commissioning tasks during construction and general order in which they occur.
 - 1. Commissioning kick-off meeting held within 90 days after all installation contractors involved in the commissioning program have been awarded a contract for the project.
 - 2. Contractor's submittals for equipment and system components included in the commissioning program are reviewed by the A/E and the CxP as specified and in accordance with the requirements of other sections of this project manual.
 - 3. CxP completes development of Functional Performance Tests protocols based on submittals and approved sequence of operations and submits to Project Team for review and comment. Final format of testing protocols, based on review comments, are prepared by CxP and distributed in sufficient time to allow the responsible contractor to complete the pre-functional performance test.
 - 4. During the Construction Phase, the CxP shall make periodic site visits to observe installation progress, conduct commissioning meetings and follow-up on open issues from past visits. Frequency of visits shall increase as systems are nearing start-up and functional testing. Observation reports shall be issued after each site visit.
 - 5. The GC and sub-contractors document proper installation and start-up of equipment utilizing the Installation Certification Form (ICF) developed by the CxP. Supplemental start up documentation and manufacturer authorized representatives start up documentation shall also be attached to the ICF.
 - 6. CxP receives the completed ICF along with the completed manufacturer's start-up form for each respective piece of equipment and/or system. During site visits, CxP may conduct random review of equipment included in completed ICF's.
 - 7. Prefunctional Performance Test documentation. After the system components have been properly installed and started in accordance with the ICF and manufacture representative start up activities, the responsible contractor shall perform a prefunctional performance test on the system utilizing the functional performance test protocols. This test shall not be witnessed by the CxP but is required prior to scheduling the FPT.
 - 8. Contractor and Owner develops Training Plan including training agendas in coordination with the OR and GC.
 - 9. Functional Performance Testing for a system shall be scheduled upon completion of the ICF's for each piece of equipment and component in a building system and Prefunctional

Performance Testing. The contractor with responsibility for the functionality of a system demonstrates system functionality to CxP. The CxP shall document the results of the testing.

10. CxP recommends acceptance of performance and functionality or recommends remedial action and re-testing.
11. GC and sub-contractors shall be responsible for providing training in accordance with the Training Plan. Training Plan schedule is coordinated with the OR by the GC.
12. Final Commissioning Report.
13. Deferred Testing.
 - a. Unforeseen Deferred Tests.
 - b. Seasonal Testing.
 - c. End-of-Warranty Review.

3.2 TEMPORARY USE OF PERMANENT BUILDING SYSTEMS DURING CONSTRUCTION

- A. Temporary use of permanent building systems shall be authorized only by the Owner in coordination with the A/E and GC.
- B. An Operations and Maintenance Plan shall be developed and submitted for review and approval. Should the temporary operation of the system include a Sequence of Operations that does not conform fully to the contract requirements, this temporary Sequence of Operations shall be in the Operations and Maintenance Plan. The temporary Sequence of Operations shall include all safeties to ensure the permanent equipment is protected against failure or damage. A/E and CxP shall review and approve the temporary Operations and Maintenance Plan prior to the contractor energizing and operating the system in the temporary mode.
- C. As the construction progresses it may be necessary to utilize building systems for temporary environmental control within the building. Should systems be used for temporary environmental control, this activity shall be sequenced into the system delivery process and involve temporary start-up and functional operations testing. Temporary conditions shall not be fully functionally tested to the extent that a duplication of effort must occur for final delivery to the Owner, once the system is fully operational and balanced. Temporary conditions must, at a minimum, meet the intent of the documentation regarding functionality, hydronic flow rates and space pressurization. The sub-contractor shall utilize the ICF for documenting the readiness of the system to be temporarily operated based upon an approved Operations and Maintenance Plan for the temporary use. The contractor shall be responsible to verify that all temporary conditions meet the requirements of the design documents.
- D. A formal verification process for temporary systems will be at the discretion of the Owner and the A/E in the event the need becomes apparent. A formal process is defined as the responsible contractor demonstrating comprehensive functionality to a representative of the Owner, CxP or A/E. The Owner shall not bear additional cost for this demonstration and the demonstration shall occur at the request of the Owner or A/E.
- E. The above applies to systems that serve areas of phased construction. Testing shall occur piecewise as determined prudent by the project team for conditions of a system considered to be permanent. The intent is to not repeat the formal functional testing process on a system except as deemed prudent for effective delivery to the Owner.

3.3 RESPONSIBILITIES

- A. Responsibilities of contractors are provided as follows (the project Commissioning Plan shall include a comprehensive list of responsibilities of all project parties):
 1. General Contractor (GC):
 - a. Include requirements for commissioning in each purchase order or subcontract written.
 - b. Ensure acceptable representation, with the means and Provider to assist the CxP in the coordination and execution of the commissioning program.

- c. Attend commissioning kick-off meeting and other commissioning team meetings. Ensure appropriate representation at these meetings by sub-contractors.
 - d. Incorporate commissioning milestones and activities including functional performance testing into master construction schedule. Maintain and update schedule, as needed, such that it is an accurate representation of construction progress through the completion of functional performance testing and resolution of all punch list issues. Also incorporate durations for scheduled training in the schedule.
 - e. Review and provide comment on the Commissioning Plan and Functional Performance Test protocols developed by CxP.
 - f. Take lead role in coordinating completion and documentation of the Installation Certification Form for equipment and components of building systems included in the Commissioning Program.
 - 1). Coordinate this activity with knowledgeable staff of.
 - 2). Once all ICF's are completed for a building system, GC shall forward them ICF's to CxP as a system package.
 - g. Coordinate the execution of prefunctional performance test documentation with the responsible contractors.
 - h. Coordinate Contractor participation in execution of the Training Plan.
 - i. Provide CxP with required documentation from commissioning activities and submittal requests.
 - j. Schedule, coordinate and assist CxP in seasonal or deferred testing and deficiency corrections required by specifications.
2. Installation Contractors:
- a. Ensure acceptable representation on the commissioning team, with the means and Provider to assist the CxP in the coordination and execution of the commissioning program.
 - b. Attend commissioning kick-off meeting and other commissioning team meetings scheduled by CxP.
 - c. Assist CxP with developing a comprehensive commissioning schedule during regularly scheduled commissioning meetings. Participate in the functional test scheduling workshop.
 - d. Complete commissioning activities as scheduled in master construction schedule.
 - e. Complete Installation Certification Form along with respective manufacturer's start-up form and submit with supporting documentation to the GC.
 - f. Address deficiencies identified during construction phase site visits in a timely manner. Within two (2) work days of notification of a deficiency, acknowledge the deficiency and implement action required to address the issue. Within five (5) work days of notification of a deficiency have deficiency corrected.
 - g. Provide certified and calibrated instrumentation to field calibrate all sensors and devices and assist during Functional Performance Testing.
 - h. Ensure installation work is complete, in compliance with Contract Documents, in accordance with approved submittals and meets or exceeds industry standards and ready for Functional Performance Testing.
 - i. Execute the prefunctional performance test successfully. Resolve any performance issues with the A/E.
 - j. Execute inspections, tests, and Functional Performance Tests as described in contract documents and Commissioning Plan. Operate systems and equipment to demonstrate proper sequences of operation.
 - k. Review Commissioning Plan and Functional Performance Test procedures.
 - l. Provide required training for Owner personnel utilizing qualified and experienced instructors.
 - m. Provide documentation according to contract documents.

- n. Address deficiencies identified during functional testing in a timely manner. Within one (1) work day of notification of a deficiency, acknowledge the deficiency and implement action required to address the issue. Within two (2) work days of notification of a deficiency have deficiency corrected unless an extension is approved by the OR and CxP.
 - o. Execute seasonal or deferred Functional Performance Testing.
3. Controls Contractor:
- a. Ensure acceptable representation, with the means and Provider to assist the CxP in the coordination and execution of the commissioning program.
 - b. Completely install and thoroughly inspect, startup, test, adjust, field calibrate, and document systems, equipment, devices, sensors, etc. controlled by the building automation system. Provided documented point-to-point check out of the system prior to functional performance testing. Field calibration of sensors and devices shall be performed even though factory calibration documentation has been provided.
 - c. Address deficiencies identified during construction phase site visits in a timely manner. Within two (2) work days of notification of a deficiency, acknowledge the deficiency and implement action required to address the issue. Within five (5) work days of notification of a deficiency have deficiency corrected.
 - d. Complete prefunctional performance tests for all sequence of operations controlled by the Building Automation System.
 - e. Assist CxP during Functional Performance Testing. Assistance shall generally include the following:
 - 1). Attend Cx progress and coordination meetings
 - 2). Complete Installation Certification Forms (ICF's) with supporting documentation and submit to the GC.
 - 3). Prepare and submit required draft forms and systems information.
 - 4). Set up trend logs of system operation at discretion of CxP.
 - 5). Demonstrate system operation to the CxP.
 - 6). Address deficiencies identified during functional testing in a timely manner. Within one (1) work day of notification of a deficiency, acknowledge the deficiency and implement action required to address the issue. Within two (2) work days of notification of a deficiency have deficiency corrected unless an extension is approved by the OR and CxP.
 - 7). Provide onsite programmer(s), in addition to those dedicated to functional testing, to correct deficiencies in control sequences during the commissioning period. Minor adjustments to program logic may be made during the functional testing at the discretion of the CxP. All other programming issues shall be completed either after hours or by utilizing additional controls technicians.
 - 8). Provide instrumentation, in calibration, necessary for field verification of all sensors and devices and Functional Performance Testing.
 - 9). Manipulate control systems to facilitate verification and Functional Performance Testing.
 - 10). Provide at least one dedicated controls technician who is totally familiar with the controls installation and program logic on the project to work with the CxP during the functional performance testing.
 - 11). Provide an as-programmed copy of the control logic for each system controlled by the Building Automation System and provide an as-built sequence of operations for each system.
4. Test Adjust Balance (TAB) Subcontractor:
- a. Ensure acceptable representation, with the means and Provider to assist the CxP in the coordination and execution of the commissioning program.
 - b. Attend Commissioning meetings.

- c. Both air and hydronic balancing of systems supporting a building system shall be completed prior to the functional performance test of the system.
- d. Once TAB record is completed, coordinate with the CxP to verify up to 10% of the record. Contractor shall utilize equipment used during initial TAB balancing for the TAB verification.
- e. Rebalance deficient areas identified during commissioning.

3.4 COMMISSIONING TEAM MEETINGS

- A. Commissioning Team Meetings shall be held periodically as determined by CxP with frequency increasing as construction advances and systems become operational. Three days prior to a scheduled meeting the CxP shall issue an Agenda and a list of meeting participants. Not all meetings will require all team members to be present. Attendance is mandatory for Contractors on the agenda participant list. CxP shall chair Commissioning Team Meetings and issue meeting minutes within two (2) days of the meeting.
- B. Discussions held in Commissioning Team Meetings shall include but not be limited to system / equipment start-up, progress, scheduling, testing, documentation, training, deficiencies, and problem resolution.

3.5 BUILDING SYSTEM MAINTENANCE/SERVICE POINT ACCESS REQUIREMENTS

- A. Each trade contractor shall be responsible for flagging all maintenance points that are located above the ceiling. Construction warning ribbon (1" minimum width) shall be securely attached to the maintenance point and, where applicable, extended down to the ceiling height level such that it is highly visible by all trades. If the location has no ceiling the ribbon shall extend a minimum of 3 feet.
- B. All trades shall ensure that unobstructed access to the maintenance point is maintained from floor level up to the point of service. Unobstructed access shall include full body access to the service point should that be required for maintenance activities. Any trade who installs systems encroaching upon the unobstructed access shall be required to relocate their material, systems and/or equipment at no additional cost to the Owner.

3.6 INSTALLATION CERTIFICATION FORM (ICF)

- A. The purpose of this certification form is to formally document the contractor's quality assurance effort as it relates to the installation and start-up of the specified piece of equipment or system component. The installing contractor responsible for the system shall be responsible for coordinating the completion of this form with the other trades supporting the installation and start-up. The individual signing this certification shall have the Provider to sign on behalf of the contractor and shall have direct personal knowledge of the equipment or system component installation. Any contractor start-up forms or manufacturer specified start-up procedures and documentation shall be attached to this certification form. The completed ICF shall be submitted to the GC.
- B. The GC shall coordinate the effort. When an installing contractor completes an ICF and submits it to the GC, the GC representative shall sign the ICF after inspecting the installation and confirming the equipment/system component, as installed, meets the requirements of the project documents and is ready for functional performance testing. The GC shall compile all ICF's for equipment/system components then submit a system package to the CxP for review.
- C. At appropriate milestones, the GC shall review the status of the completion of the ICF's with each contractor to ensure progress in completing this documentation does not delay the start of functional testing.
- D. Lead Trade Contractor and supporting trade contractors shall execute the ICF and provide the GC with an original signed and dated form. Only individuals with the Provider to sign as the contractor representative and having direct knowledge of the installation and start-up of the

equipment or system component shall sign Installation Certification Form. The CxP receives completed ICF's from the GC as system packages. Once all equipment and system component certification forms have been submitted for a building system the contractor shall proceed with the Pre-Functional Performance Testing.

E. The OR, A/E or CxP reserve the right to witness any startup and preliminary equipment testing.

3.7 FUNCTIONAL PERFORMANCE TESTING

A. General:

1. Refer to Section 01 9114 for additional details regarding the functional performance testing.

B. Objectives and Scope:

1. Each system shall be operated through all modes of operation (normal operation, failure/recovery operation, seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load, etc.) where there is a specified system response. Verifying each sequence in the specified sequence of operation is required including responses to conditions such as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. The first step in achieving these objectives is the successful execution of the FPT by the responsible contractor as a prefunctional performance test prior to demonstrating the system operation to the CxP.
2. The contractor responsible for the dynamic operation of a system shall demonstrate comprehensive functionality of that system. All contractors that have contributed to the installation of the same system shall not be required to directly participate in the functional testing activity but shall be required to be immediately available for reconciliation of issues that fall within their scope and responsibility during testing.
3. Functional Performance Testing witnessed by the CxP shall be considered successful when repeatable acceptable outcomes meeting the Basis of Design criteria are achieved.

C. Coordination and Scheduling:

1. Functional Performance Testing is conducted following completion of all installation and start-up contractor activities for all equipment and system components associated with the building system. The ICF's for all system equipment/components shall be completed by the installing contractors, submitted by the GC and reviewed by the CxP prior to performing the Pre-Functional Performance Test. Once both of these tasks are complete and reviewed by the CxP, the Functional Performance Test shall be scheduled.
2. Coordination and final scheduling confirmation of Functional Performance Testing shall occur during regularly scheduled commissioning meetings.
3. All commissioning activities shall be fully integrated into the construction activity schedule. This includes milestone deadlines for completion of installation of major system components and the durations for functional testing of a system.
4. The GC shall provide sufficient notice to CxP regarding changes to the coordinated completion schedule for systems testing.
5. CxP shall witness and document Functional Performance Testing of systems. Designated sub-contractor or vendor responsible for dynamic operation of a system or device shall demonstrate system functionality to CxP.
6. Functional Performance Test discrepancies shall be issued upon completion of a system test, or portion thereof should the deficiency preclude continuation of testing.

D. Test Strategy

1. Each contractor shall comprehensively test and document all building systems in the Commissioning Program for which they are responsible utilizing the Pre-Functional Performance Test Document. Any discrepancies or issues identified during the Pre-Functional Performance Test shall be resolved then retested and documented by the installation contractor.

2. Once the successful Pre-Functional Performance Test has been documented, then the CxP shall witness and document the Functional Performance Test for the record.
3. Systems that contain many repeated identical devices may be selected and demonstrated to the project team based on the sampling strategy indication in paragraph 1.3A of this specification.

E. Non-Conformance:

1. CxP shall document results of Functional Performance Test to FPT forms. Deficiency or non-conformance issues shall be noted and reported to commissioning team as a punch list item with specific responsibility indicated.
2. Corrections of minor deficiencies identified may be made during testing at discretion of CxP. In such case, deficiency and resolution shall be documented on procedure form and to punch list as a resolved issue.
3. Every effort shall be made to expedite testing and minimize unnecessary delays, while not compromising integrity of procedures.
4. Deficiencies are handled in the following manner:
 - a. When there is no dispute on deficiency and Contractor accepts responsibility for remedial action:
 - 1). CxP documents deficiency and contractor's response and intention. CxP posts issue to action list. Contractor corrects deficiency and resubmits to CxP. Contractor addresses all issues noted on action list by correcting deficiencies or by posting date for completion of resolution of deficiency.
 - 2). Contractor shall provide a response pertaining to the deficiency within one (1) work day of notification of the deficiency. This response shall include the contractor's intentions for addressing the issue. Contractor shall satisfactorily address the issue including completion of the corrective actions within two (2) work days of the initial notification of the deficiency unless an extension is authorized by the OR and CxP.
 - 3). The GC reschedules test with CxP and contractor. New test time is posted to project schedule.
 - b. When there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:
 - 1). CxP documents deficiency and contractor's response and testing proceeds on subsequent test or sequence. CxP posts issue to punch list and distributes to team.
 - 2). The GC facilitates resolution of deficiency. Other parties are brought into discussions as needed. Final interpretive Provider is with A/E. Final acceptance Provider is with the Owner.
 - 3). CxP documents resolution process.
 - 4). Once interpretation and resolution has been decided, appropriate party corrects deficiency, and CxP is given notice to proceed for retest. The GC and CxP reschedule test. New test time is posted to project schedule.

F. Cost of Retesting:

1. Cost to contractor to recheck Installation Certification Form, re-execute the prefunctional performance test or the FPT, if they are responsible for deficiency or failure, shall be theirs. If contractor is not responsible, cost recovery for re-visitation shall be negotiated with the GC. Final determination as to whether the ICF, PFT or FPT was properly executed as it relates to the project documents and the Basis of Design falls with the A/E.
2. Time for CxP to witness and document any retesting required because a specific Installation Certification Form, start-up test item or prefunctional performance test reported to have been successfully completed, but determined during Functional Performance Testing to be faulty, shall be back charged to the contractor.
3. Contractors shall be held responsible for expenses incurred by Owner for retesting due to the contractor's state of reported readiness or lack thereof as represented on the completion

of all commissioning documentation required prior to the FPT. Expenses could include, but not be limited to, retesting labor costs, travel expenses, and remobilization for owner and consulting teams.

G. Approval:

1. CxP notes each satisfactorily demonstrated function on test form. CxP, GC, and OR provide formal approval of FPT after review.

3.8 DEFERRED TESTING

A. Unforeseen Deferred Tests:

1. Any testing that is not completed prior to substantial completion due to reasons beyond the control of the GC or at the request of the Owner shall be conducted as soon after substantial completion as possible so as not to disrupt the building occupants when the facility is fully occupied.

- B. Opposite Season Testing: Testing procedures shall be repeated and/or conducted as necessary during appropriate seasons. "Opposite season" testing is primarily for environmental systems and shall be required where scheduling prohibits thorough testing in all modes of operation. Opposite season testing may also be required when conditions have been simulated to observe the response of the system. The CxP shall schedule the opposite season testing during the warranty period to coincide with a design day condition when possible. Alternatively, should the testing during the normal testing period demonstrated the acceptability of the program logic for the opposite season, then trending of the system during the opposite season is also an acceptable means of documenting operational performance.

END OF SECTION 01 91 13

SECTION 01 91 14 - FUNCTIONAL TESTING REQUIREMENTS

PART 1 - GENERAL

1.1 INCLUDED SYSTEMS AND EQUIPMENT

A. The following systems and equipment included in commissioning program. The sampling rate shown indicates what percentage of system components shall be tested during the functional performance period.

1. Division 14 – Conveying Equipment	Sampling Rate
a. Elevators	100%
2. Division 21 – Fire Protection	Sampling Rate
a. Fire Protection System	100%
3. Division 22 - Plumbing	Sampling Rate
a. Sump Systems	100%
b. Water Supply Including Circulation Systems & Auto Valves	100%
4. Division 23 - Heating Ventilating and Air Conditioning	Sampling Rate
a. Rooftop Unit With DX Cooling	100%
b. Computer Room Air Conditioning Units	100%
c. Variable Air Volume Boxes	20%
d. Fan Coil Units	20%
e. Cabinet Unit Heaters	20%
f. Unit Heaters	20%
g. Toilet Exhaust	100%
h. Gas Fired Rooftop Units	100%
i. Boilers	100%
j. DDC Building Control System	100%
k. Test, Adjust and Balance Verification	5%
5. Division 26 - Electrical	Sampling Rate
a. Lighting Control System	100%
b. Power Monitoring & Control	100%
c. Variable Frequency Drives	100%
d. Electrical Distribution, Greater Than 40A	100%
e. Automatic Transfer Switches	100%
6. Division 28 – Electronic Safety and Security	Sampling Rate
a. Fire Alarm System	100%

1.2 DESCRIPTION

A. This section specifies the functional testing requirements for, 14, 21, 22, 23, 26, and 28 systems and equipment. From these requirements, the Commissioning Provider (CxP) shall develop step-by-step procedures to be executed by the Subs or the CxP. The general functional testing process, requirements and test method definitions are described in Section 01 9113. The test requirements for each piece of equipment or system contain the following:

1. The contractors responsible to execute the tests, under the direction of the CxP.
2. A list of the integral components being tested.
3. Functions and modes to be tested.

4. Required conditions of the test for each mode.
 5. Special procedures.
 6. Required methods of testing.
 7. Required monitoring.
 8. Acceptance criteria.
 9. Sampling strategies allowed.
- B. The functional performance testing protocols developed shall be used as follows:
1. The responsible contractor shall perform a Prefunctional Performance Test utilizing the testing protocol. During the execution of test, the contractor may encounter issues or requires clarification to a test procedure that may require coordination with both the A/E and the CxP. Any changes or modifications to the test protocol shall be made by the CxP for use in the final test effort. Any changes to the test protocol that result in changes to the sequence of operation of the system shall require written approval by the A/E. Once written approval is obtained from the A/E, the control sequence changes shall be incorporated into the test protocol by the CxP. The Contractor shall be responsible for performing and documenting the test results should the control sequences be modified.
 2. Upon completion of the prefunctional testing documentation by the contractor, the Functional Performance Test protocol shall be updated to reflect any approved changes or modifications and then used by the CxP to witness and document the final testing by the contractor.

1.3 PREREQUISITES

- A. The first prerequisite for the start of functional performance testing is the completion and acceptance of the Installation Certification Form (ICF) for each system and/or system component. Refer to Section 01 9113 for information regarding the Installation Certification Form (ICF). The second prerequisite for the start of functional performance testing is the prefunctional performance test documentation from the responsible contractor.
- B. The Controls Sub-Contractor shall have completed the BAS network communication for the entire system, verified and completed the BAS graphics package and confirm the availability of a dedicated controls technician knowledgeable with the programming for the project during the functional performance testing.
- C. All test and Balance (TAB) work shall be completed for the respective and associated systems that are to be tested.

1.4 MONITORING

- A. Monitoring is a method of testing as a stand-alone method or to augment manual testing.
- B. All points listed in the required monitoring section of the test requirements that are control system monitored points shall be trended by the Controls Subcontractor. Other points shall be monitored by the CxP using data loggers or other independent stand-alone devices. At the option of the CxP, some control system monitoring may be replaced with data logger monitoring. At the CxP's request, the Controls Subcontractor shall trend up to 20% more points than listed herein at no extra charge.
- C. Systems not controlled by the integrated automation system: Systems like the fire detection system or prepackaged control systems for boilers or chillers, events logs shall be set up by the contractor to record all events and alarms during the period of testing
- D. Copies of monitored trend data shall also be provided in electronic format in either Microsoft Excel or Word.

- E. Graphical output is desirable, and will be required for all output, if the system can produce it.

PART 2 - PRODUCTS

- A. NOT APPLICABLE

PART 3 - EXECUTION

3.1 DIVISION 14 – CONVEYING SYSTEMS

A. Elevator

1. Obtain documentation indicating correct equipment has been provided and installed as specified. Include all manufacturer and installer certifications as specified.
2. Perform testing verifying the elevator door operation (open and closing)
3. Verify operation under fire alarm conditions.
4. Verify operation during emergency power operations.

3.2 DIVISION 21 – FIRE PROTECTION

A. Fire Protection System

1. Parties Responsible to Execute Functional Test
 - a. Fire Protection Contractor: to perform testing
 - b. Fire Detection Contractor to assist in testing
 - c. CxP: direct, witness, and document testing
2. Integral Components or Related Equipment Being Tested as applicable for the specific unit
 - a. Fire Protection System
3. Functions / Modes Required To Be Tested
 - a. Testing requirements for commissioning are in addition to and do not replace any testing requirements elsewhere in this Division.
 - b. Commissioning testing shall include but not be limited to the following:
 - 1). Flow and Tamper Switches
 - 2). Fire Pump
4. Required Monitoring
 - a. None

B. Acceptance Criteria (referenced by function or mode ID)

1. For the conditions, sequences and modes tested, the fire protection system, integral components and related equipment respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.

3.3 DIVISION 22 - PLUMBING

A. Plumbing related systems

1. Parties Responsible to Execute Functional Test
 - a. CxP: perform and document testing.
 - b. Plumbing contractor: operate the controls to activate the equipment.
2. Integral Components or Related Equipment Being Tested as applicable for the specific unit
 - a. Equipment, systems, and associated devices for systems in the commissioning scope of work as listed above in section 1.1

3. Functions / Modes Required To Be Tested
 - a. Testing requirements for commissioning are in addition to and do not replace any testing requirements elsewhere in this Division.
 - b. Commissioning testing shall include but not be limited to the following:
 - 1). Domestic Water Heaters
 - a). Recovery Rate
 - b). Temperature Control
 - c). Staging
 - 2). Potable Hot/Cold Systems
 - a). Pressure Control
 - b). Mixing Valves
 - c). Fixture Sensors
 - d). Temperature
 - 3). Sump Pumps
 - a). Location of Level Floats
 - b). Operation of Pump Staging
 - c). Alarms
 4. Required Monitoring
 - a. None
 5. Acceptance Criteria (referenced by function or mode ID)
 - a. For the conditions, sequences and modes tested, the heating hot water integral components and related equipment respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.

B. Sump Pumps

1. Parties Responsible to Execute Functional Test
 - a. Plumbing contractor: operate the controls to activate the equipment.
 - b. Controls Contractor: assist in testing sequences (Monitoring Alarms).
 - c. CxA: direct, witness and document testing
2. Integral Components or Related Equipment Being Tested as applicable for the specific unit
 - a. Sump Pumps
3. Functions / Modes Required To Be Tested
 - a. Testing requirements for commissioning are in addition to and do not replace any testing requirements elsewhere in this Division.
 - b. Test methods shall include manual, auto, emergency operations and monitoring as applicable and feasible.
 - c. Commissioning testing shall include but not be limited to the following:
 - 1). Verify all alarms and safeties
 - 2). Verify sensor calibration checks on any controlling equipment
 - 3). Verify schedules and setpoints to be reasonable and appropriate
 - 4). Verify floats activate the pumps
 - 5). Verify high-level water alarm
 - 6). Verify low-level water alarm
 - 7). Verify the sequencing of the each pump

- 8). Determine the diversity/recovery rate in system (if any) then test to maximum diversity.

4. Acceptance Criteria

- a. For the conditions, sequences and modes tested, the sump pumps, integral components and related equipment respond to varying loads and changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.

3.4 DIVISION 23 - HEATING VENTILATING AND AIR CONDITIONING

A. General

1. Required Monitoring

- a. All controlled parameters, respective setpoints, and output points/values for controlling devices shall be trended at a sampling rate specified by the Owner. The controls contractor shall program the respective trend logs in the BAS. All other points that are control system monitored points shall be made available for trending and respective trend logs shall be programmed by the Controls Contractor if owner or CxP require these (any or all) points to be (historically) trended. Other points may be monitored by the CxP using data loggers. During Functional Testing, trend log sampling rates may be increased to monitor responses to various control sequences and failure scenarios.

2. Acceptance Criteria for Air Handling Systems

- a. For the conditions, sequences and modes tested, the HVAC equipment and/or other building systems, integral components and related equipment respond to varying loads and changing conditions and parameters appropriately as expected, as specified, and according to acceptable operating practice.
- b. HVAC equipment and supporting systems shall be able to maintain the respective controlled temperature and humidity within specified tolerances either side of the current setpoint without excessive hunting.
- c. HVAC equipment and controls shall control the duct static pressure and/or air flows to maintain the controlled parameter within specified tolerances either side of the setpoint value without excessive hunting.

3. Acceptance Criteria for Hydronic Systems

- a. For the conditions, sequences and modes tested, the chilled water system, integral components and related equipment respond to varying loads and changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.
- b. Chiller shall maintain the chilled water supply setpoint to within +/- 1.0F of setpoint deadband without excessive hunting.
- c. Pumping system and controls shall maintain the current desired pressure setpoint to within an amount equal to [5%] of the setpoint value either side of the deadband without excessive hunting.

4. Acceptance Criteria for Building Automation System(BAS) and Test and Balance (TAB) Report

- a. A failure of more than 10% of the randomly selected items shall result in the failure of acceptance of the BAS system or the TAB report.
5. BAS contractor shall be responsible for performing a new point-to-point verification check, provide documentation and repeat the random verifications of the system
6. TAB contractor shall be responsible to rebalance the system, provide a new system TAB report and repeat random verifications of the new TAB report.

B. Humidifiers

1. Parties Responsible to Execute Functional Test
 - a. Controls contractor: operate the controls to activate the equipment as needed.
 - b. HVAC mechanical contractor: assist in testing sequences as needed.
 - c. CxP: to witness, direct and document testing.
2. Integral Components or Related Equipment Being Tested as applicable for the specific unit
 - a. Air Handling Units
3. Functions / Modes Required To Be Tested
 - a. Testing requirements for commissioning are in addition to and do not replace any testing requirements elsewhere in this Division.
 - b. Test methods shall include manual, auto, emergency operations and monitoring as applicable and feasible.
 - c. Commissioning testing shall include but not be limited to the following:
 - 1). Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned; including startup, shutdown, component failure, unoccupied & manual modes and power failure. Test functionality of this piece of equipment or system in all control strategies or interlocks with which it is associated. This testing shall include the following as applicable:
 - a). Sensor activator calibration checks
 - b). Device and actuator calibration and stroke checks
 - c). Control parameters and setpoints are reasonable and appropriate
 - 2). Control loops are tuned to eliminate hunting or significant overshoot
 - 3). Alarms

C. Exhaust Fans

1. Parties Responsible to Execute Functional Test
 - a. Controls contractor: operate the controls to activate the equipment as needed.
 - b. HVAC mechanical contractor: assist in testing sequences as needed.
 - c. CxP: to witness, direct and document testing.
2. Integral Components or Related Equipment Being Tested
 - a. Exhaust fans
3. Functions / Modes Required To Be Tested
 - a. Testing requirements for commissioning are in addition to and do not replace any testing requirements elsewhere in this Division.
 - b. Test methods shall include manual, auto, emergency operations and monitoring as applicable and feasible.
 - c. Commissioning testing shall include but not be limited to the following:
 - 1). Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned; including startup, shutdown, component failure, unoccupied & manual modes and power failure. Test functionality of this piece of equipment or system in all control strategies or interlocks with which it is associated. This testing shall include the following as applicable:
 - a). Schedules and setpoints are reasonable and appropriate
 - b). Interlocks to building pressurization control
 - 2). Sensor and actuator calibration checks: Sensor and actuator calibration completed by contractor in ICF Calibration document. Random sampling checks by CxP during

functional testing. (BAS readout against hand-held calibrated instrument or observation must be within specified tolerances)

D. Fan Coil

1. Parties Responsible to Execute Functional Test
 - a. Controls contractor: operate the controls to activate the equipment as needed.
 - b. CxP: to witness, direct and document testing.
2. Integral Components or Related Equipment Being Tested as applicable for the specific unit
 - a. Fan Coil
3. Functions / Modes Required To Be Tested
 - a. Testing requirements for commissioning are in addition to and do not replace any testing requirements elsewhere in this Division.
 - b. Test methods shall include manual, auto, emergency operations and monitoring as applicable and feasible.
 - c. Commissioning testing shall include but not be limited to the following:
 - 1). Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned; including startup, shutdown, component failure, unoccupied & manual modes and power failure. Test functionality of this piece of equipment or system in all control strategies or interlocks with which it is associated. This testing shall include the following as applicable:
 - a). Monitor and trend room temperature data
 - 2). Alarms

E. Unit Heaters

1. Parties Responsible to Execute Functional Test
 - a. Controls contractor: operate the controls to activate the equipment as needed.
 - b. CxP: to witness, direct and document testing.
2. Integral Components or Related Equipment Being Tested as applicable for the specific unit
 - a. Unit Heaters
3. Functions / Modes Required To Be Tested
 - a. Testing requirements for commissioning are in addition to and do not replace any testing requirements elsewhere in this Division.
 - b. Test methods shall include manual, auto, emergency operations and monitoring as applicable and feasible.
 - c. Commissioning testing shall include but not be limited to the following:
 - 1). Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned; including startup, shutdown, component failure, unoccupied & manual modes and power failure. Test functionality of this piece of equipment or system in all control strategies or interlocks with which it is associated. This testing shall include the following as applicable:
 - a). Monitor and trend room temperature data
 - 2). Alarms

F. Cabinet Unit Heaters

1. Parties Responsible to Execute Functional Test
 - a. Controls contractor: operate the controls to activate the equipment as needed.
 - b. CxA: direct, witness and document testing
2. Integral Components or Related Equipment Being Tested as applicable for the specific unit

- a. Cabinet Unit Heaters
- 3. Functions / Modes Required To Be Tested
 - a. Testing requirements for commissioning are in addition to and do not replace any testing requirements elsewhere in this Division.
 - b. Commissioning testing shall include but not be limited to testing each sequence in the sequence of operations, and other significant modes and sequences not mentioned; including startup, shutdown, component failure, unoccupied & manual modes and power failure. Test functionality of this piece of equipment or system in all control strategies or interlocks with which it is associated. Test methods shall include manual, auto, emergency operations and monitoring as applicable and feasible. Testing shall include but not be limited to the following:
 - 1). Verify that airflow is as per schedule
 - 2). Manipulate terminal devices through all sequences of operation and verify proper operation.
 - 3). Monitor and trend room temperature sensors.
 - 4). All alarms

G. Heat Pumps

- 1. Parties Responsible to Execute Functional Test
 - a. Controls contractor: operate the controls to activate the equipment as needed.
 - b. CxP: to witness, direct and document testing.
- 2. Integral Components or Related Equipment Being Tested as applicable for the specific unit
 - a. Dedicated Outside Air Handling Unit
- 3. Functions / Modes Required To Be Tested
 - a. Testing requirements for commissioning are in addition to and do not replace any testing requirements elsewhere in this Division.
 - b. Test methods shall include manual, auto, emergency operations and monitoring as applicable and feasible.
 - c. Commissioning testing shall include but not be limited to the following:
 - 1). Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned; including startup, shutdown, component failure, unoccupied & manual modes and power failure. Test functionality of this piece of equipment or system in all control strategies or interlocks with which it is associated. This testing shall include the following as applicable:
 - a). Monitor and trend room temperature data
 - b). Device and actuator calibration and stroke checks
 - c). Control parameters and setpoints are reasonable and appropriate
 - 2). Control loops are tuned to eliminate hunting or significant overshoot
 - 3). Alarms

H. Air Terminal Boxes

- 1. Parties Responsible to Execute Functional Test
 - a. Controls contractor: operate the controls to activate the equipment as needed.
 - b. CxP: to witness, direct and document testing.
- 2. Integral Components or Related Equipment Being Tested as applicable for the specific unit
 - a. Air Terminal Boxes – Office
- 3. Functions / Modes Required To Be Tested

- a. Testing requirements for commissioning are in addition to and do not replace any testing requirements elsewhere in this Division.
 - b. Test methods shall include manual, auto, emergency operations and monitoring as applicable and feasible.
 - c. Commissioning testing shall include but not be limited to the following:
 - 1). Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned; including startup, shutdown, component failure, unoccupied & manual modes and power failure. Test functionality of this piece of equipment or system in all control strategies or interlocks with which it is associated. This testing shall include the following as applicable:
 - a). Monitor and trend room temperature data
 - b). Device and actuator calibration and stroke checks
 - c). Control parameters and setpoints are reasonable and appropriate
 - 2). Control loops are tuned to eliminate hunting or significant overshoot
 - 3). Alarms
- I. Water Cooled Computer Room Air Conditioning Units
- 1. Parties Responsible to Execute Functional Test
 - a. Controls contractor: operate the controls to activate the equipment as needed.
 - b. CxA: direct, witness and document testing
 - 2. Integral Components or Related Equipment Being Tested as applicable for the specific unit
 - a. Water-Cooled Computer Room Air Conditioning Units
 - 3. Functions / Modes Required To Be Tested
 - a. Testing requirements for commissioning are in addition to and do not replace any testing requirements elsewhere in this Division.
 - b. Commissioning testing shall include but not be limited to testing each sequence in the sequence of operations, and other significant modes and sequences not mentioned; including startup, shutdown, component failure, unoccupied & manual modes and power failure. Test functionality of this piece of equipment or system in all control strategies or interlocks with which it is associated. Test methods shall include manual, auto, emergency operations and monitoring as applicable and feasible. Testing shall include but not be limited to the following:
 - 1). Activate air conditioning unit using remote wall mounted microprocessor control keypad.
 - 2). Check that all dampers modulate freely
 - 3). Verify that condensate drain is functioning properly.
 - 4). Verify cooling capacity
 - 5). Verify smoke detector operation
- J. Chilled Water System
- 1. The cooling tower can be tested integrally with the chiller testing. The cooling tower test requirements are listed elsewhere.
 - 2. Parties Responsible to Execute Functional Test
 - a. Controls subcontractor: operate the controls as needed.
 - b. HVAC mechanical contractor or vendor: assist in testing sequences as needed.
 - c. CxP: to witness, direct and document testing.
 - 3. Integral Components or Related Equipment Being Tested
 - a. Chilled water piping system

- b. Pumps
 - c. Variable Frequency Drives
4. Functions / Modes Required To Be Tested
- a. Testing requirements for commissioning are in addition to and do not replace any testing requirements elsewhere in this Division.
 - b. Test methods shall include manual, auto, emergency operations and monitoring as applicable and feasible.
 - c. Commissioning testing shall include but not be limited to the following:
 - 1). Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned; including startup, shutdown, component failure, unoccupied & manual modes and power failure. Test functionality of this piece of equipment or system in all control strategies or interlocks with which it is associated. This testing shall include the following as applicable:
 - a). Failure and recovery scenarios for pumps
 - b). Device and actuator calibration and stroke checks
 - c). Control parameters and setpoints are reasonable and appropriate
 - 2). Control loops are tuned to eliminate hunting or significant overshoot on system pressure and temperature
 - 3). Alarms

K. Heating Hot Water System

- 1. Parties Responsible to Execute Functional Test
 - a. Controls Subcontractor: operate the controls, to activate the equipment as needed.
 - b. HVAC Mechanical Contractor or vendor: assist in testing sequences as needed.
 - c. CxP: to witness, direct and document testing.
- 2. Integral Components or Related Equipment Being Tested as applicable:
 - a. Heat Exchanger
 - b. Supply pumps
 - c. Heating water piping system
 - d. Variable Frequency Drives
- 3. Functions / Modes Required To Be Tested
 - a. Testing requirements for commissioning are in addition to and do not replace any testing requirements elsewhere in this Division.
 - b. Test methods shall include manual, auto, emergency operations and monitoring as applicable and feasible.
 - c. Commissioning testing shall include but not be limited to the following:
 - 1). Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned; including startup, shutdown, component failure, unoccupied & manual modes and power failure. Test functionality of this piece of equipment or system in all control strategies or interlocks with which it is associated. This testing shall include the following as applicable:
 - a). Failure and recovery scenarios for pumps
 - b). Staging on and off heat exchangers
 - c). Device and actuator calibration and stroke checks
 - d). Control parameters and setpoints are reasonable and appropriate
 - e). Supply water temperature reset

- 2). Control loops are tuned to eliminate hunting or significant overshoot on system pressure and temperature
- 3). Alarms

L. Steam and Condensate System

1. Parties Responsible to Execute Functional Test
 - a. Controls Contractor: operate the controls, as needed.
 - b. HVAC Mechanical Contractor or vendor: assist in testing sequences.
 - c. CxP: to witness, direct and document testing.
2. Integral Components or Related Equipment Being Tested as applicable:
 - a. Steam/condensate piping system
 - b. Steam/condensate piping specialties
 - c. Heat Exchangers
3. Functions / Modes Required To Be Tested
 - a. Testing requirements for commissioning are in addition to and do not replace any testing requirements elsewhere in this Division.
 - b. Test methods shall include manual, auto, emergency operations and monitoring as applicable and feasible.
 - c. Commissioning testing shall include but not be limited to the following:
 - 1). Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned; including startup, shutdown, component failure, unoccupied & manual modes and power failure. Test functionality of this piece of equipment or system in all control strategies or interlocks with which it is associated. This testing shall include the following as applicable:
 - a). Staging steam valves based on steam demand
 - b). Staging on and off heat exchangers
 - c). Testing steam traps and condensate return pumping units
 - d). Steam pressure control
 - 2). Control loops are tuned to eliminate hunting or significant overshoot on system pressure and temperature
 - 3). Alarms

M. Building Automation System (BAS)

1. Parties Responsible to Execute Functional Test
 - a. Controls Subcontractor: operate the controls to activate the equipment.
 - b. CxP: to witness, direct and document testing.
2. Integral Components or Related Equipment Being Tested as applicable:
 - a. Building Automation System
 - b. Calibration Certification Documents
3. Functions / Modes Required To Be Tested and Test Methods.
 - a. A significant part of the BAS functional testing requirements is the successful completion of the functional tests of equipment the BAS controls or interlocks with. Uncompleted equipment functional tests or outstanding deficiencies shall be completed prior to conclusion of the functional testing of the BAS.
 - b. Integral or stand-alone controls are functionally tested with the equipment they are attached to, including any interlocks with other equipment or systems and thus are

not covered under the BAS testing requirements, except for any integrated functions or interlocks listed below.

- c. Testing requirements for commissioning are in addition to and do not replace any testing requirements elsewhere in this Division.
- d. Test methods shall include manual, auto, emergency operations and monitoring as applicable and feasible.
- e. Commissioning testing shall include but not be limited to the following:
 - 1). Power failure and battery backup and power-up restart functions
 - 2). Global commands features
 - 3). Security and access codes
 - 4). Occupant over-rides (manual, telephone, key, keypad, etc.)
 - 5). Scheduling features fully functional and setup, including holidays
 - 6). Date and time setting in central computer and verify field panels read the same time
 - 7). All graphic screens and value readouts completed
 - 8). Communications to remote sites
 - 9). Final as-builts or redlines (per spec) control drawings, final points list, program code, setpoints, schedules, warranties, etc. per specs, submitted for O&M's
 - 10). Alarm notification system and alarm priorities
 - 11). Optimum start-stop functions
 - 12). Auto-tuning disabled

N. Test, Adjust and Balance Verification

- 1. Parties Responsible to Execute Functional Test
 - a. TAB contractor: perform checks using test instruments
 - b. Controls subcontractor: operate the controls to activate the equipment.
 - c. CxP: to witness, direct and document testing.
- 2. Integral Components or Related Equipment Being Tested as applicable for the specific unit
 - a. TAB water-side
 - b. TAB air-side
- 3. Functions / Modes Required To Be Tested
 - a. Testing requirements for commissioning are in addition to and do not replace any testing requirements elsewhere in this Division.
 - b. Test methods shall include manual, auto, emergency operations and monitoring as applicable and feasible.
 - c. Commissioning testing shall include but not be limited to the following:
 - 1). A random sample of up to 15% the TAB report data shall be selected for verification (air velocity, air or water flow rate, pressure differential, electrical or sound measurement, etc.). The original TAB contractor will execute the checks, witnessed by the CxP. The TAB contractor will use the same test instruments as used in the original TAB work

3.5 DIVISION 26 - ELECTRICAL

A. Normal Power Electric Service Distribution

- 1. Parties Responsible to Execute Functional Test
 - a. Electrical Subcontractor: assist in testing sequences, as needed.
 - b. CxP: to witness, direct and document testing.

2. Integral Components or Related Equipment Being Tested
 - a. Switchgear
 - b. Unit Substations
 - c. Distribution Panelboards
 3. Functions / Modes Required To Be Tested
 - a. Testing requirements for commissioning are in addition to and do not replace any testing requirements elsewhere in this Division.
 - b. Test methods shall include manual, auto, emergency operations and monitoring as applicable and feasible.
 - c. Commissioning testing shall include but not be limited to the following:
 - 1). Infrared scan of connections of select components and connections. Any PPE required for the CxP to comply with arc-flash requirements shall be provided by the contractor. Contractor shall also open and reclose all equipment being scanned.
 - 2). Randomly check trip settings on breakers to confirm they match the settings in the short circuit coordination study
 - 3). Test the power management control sequence for the switchgear
 - 4). Spot check phase balance at panelboards after system is under load. Ensure proper, thorough and accurate identification of load. Trip breakers and validate load identified. Test GFI breakers
 - 5). Spot check circuit labeling by de-energizing circuits while circuit tester is in the receptacle. Labeling shall be checked on the load/receptacle and at the breaker
 - 6). Receptacle Polarity Test: Spot check receptacles installed or reconnected under this contract with a receptacle circuit tester. Tester shall test for open ground, reverse polarity, open hot, open neutral, hot and ground reversed, hot or neutral and hot open
 4. Required Monitoring
 - a. None
 5. Acceptance Criteria
 - a. The normal power system, integral components and related equipment respond to varying parameters appropriately as expected, as specified and according to acceptable operating practice.
- B. Emergency Power Distribution
1. Parties Responsible to Execute Functional Test
 - a. Controls Subcontractor: operate the controls
 - b. Electrical Subcontractor: Provide load banks and all testing instruments and assist in testing sequences and debugging.
 - c. Mechanical Subcontractor: assist in testing sequences and debugging
 - d. CxP: to coordinate, witness, direct and document testing.
 2. Integral Components or Related Equipment Being Tested
 - a. Emergency generator
 - b. Automatic transfer switches
 - c. Emergency Power distribution panelboards and circuits
 - d. Emergency Lighting
 - e. Building Automation System
 - f. Fire Alarm System
 3. Functions / Modes Required To Be Tested

- a. Testing requirements for commissioning are in addition to and do not replace any testing requirements elsewhere in this Division.
 - b. Test methods shall include manual, auto, emergency operations and monitoring as applicable and feasible.
 - 1). Load banks for testing automatic transfer switches shall be provided by the electrical contractor. The load bank shall be sufficiently sized for the maximum load specified for the automatic transfer switch. One load bank can be used and relocated for each individual test if multiple transfer switches are installed
 - 2). Contractor shall provide all necessary labor and material to connect the load bank to the load side of the transfer switch and then after testing removing same from the project site.
 - c. Commissioning testing shall include but not be limited to the following:
 - 1). Generator safeties and alarms (including high and low oil pressure, high temperature, over-speed, etc.) and interface with BAS
 - 2). Power management control sequence test for loss of normal power, transfer to emergency power then return back to normal power. If authorized by Owner, phase loss scenarios will also be included to confirm specified equipment have phase loss protection.
 - 3). Infrared scan of connections of select components and connections. Any PPE required for the CxP to comply with arc-flash requirements shall be provided by the contractor. Contractor shall also open and reclose all equipment being scanned.
 - 4). Spot check phase balance at panelboards after system is under load. Ensure proper, thorough and accurate identification of load. Trip breakers and validate load identified. Test GFI breakers
 - 5). Spot check circuit labeling by de-energizing circuits while circuit tester is in the receptacle. Labeling shall be checked on the load/receptacle and at the breaker
 - 6). Receptacle Polarity Test: Spot check receptacles installed or reconnected under this contract with a receptacle circuit tester. Tester shall test for open ground, reverse polarity, open hot, open neutral, hot and ground reversed, hot or neutral and hot open
 - 7). BAS sequencing of equipment start-up upon loss and return of power
 - 8). Emergency lighting adequacy for egress routes. Lighting levels for egress paths shall be recorded. Lighting levels for egress paths shall be done at night.
4. Acceptance Criteria
- a. For the conditions, sequences and modes tested, the emergency generator, integral components and related equipment respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.

C. Lighting Control System

- 1. Parties Responsible to Execute Functional Test
 - a. Electrical Contractor: assist in testing sequences, as needed.
 - b. CxP: to witness, direct and document testing.
- 2. Integral Components or Related Equipment Being Tested
 - a. Lighting Control System
- 3. Functions / Modes Required To Be Tested
 - a. Testing requirements for commissioning are in addition to and do not replace any testing requirements elsewhere in this Division.

- b. Test methods shall include manual, auto, emergency operations and monitoring as applicable and feasible.
- c. Commissioning testing shall include but not be limited to the following:
 - 1). Spot check occupancy sensor placement and sensitivity for activation/deactivation
 - 2). Spot check lighting schedules to ensure they are programmed per the owner direction
 - 3). Check lighting levels
 - 4). For exterior fixtures, simulate night mode to validate function. Measure and record light level to ensure they meet the requirements and are generally provide adequate security. Check for excessive light level fluctuations or dark spots

3.6 DIVISION 28 - FIRE ALARM SYSTEM

- A. Parties Responsible to Execute Functional Test
 - 1. Fire Alarm contractor: operate the controls to activate the equipment
 - 2. CxP: to witness, direct and document testing
 - 3. Fire Marshal: to witness, direct and document testing
- B. Integral Components or Related Equipment Being Tested
 - 1. Fire Pump, Alarm System & Components
- C. Functions / Modes Required To Be Tested
 - 1. Testing requirements for commissioning are in addition to and do not replace any testing requirements elsewhere in this Division.
 - 2. Test methods shall include manual, auto, emergency operations and monitoring as applicable and feasible.
 - 3. Testing will be performed concurrent with testing witnessed by Fire Marshal
 - 4. Commissioning testing shall include but not be limited to the following:
 - a. Test equipment shutdown and restart sequence for trouble and supervisory alarms
 - b. Test backup battery capacity per requirements
- D. Required Monitoring
 - 1. None
- E. Acceptance Criteria
 - 1. For the conditions, sequences and modes tested, the fire alarm system, integral components and relate equipment respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.

END OF SECTION 01 91 14

SECTION 03 45 00 - PRECAST ARCHITECTURAL 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. This Section includes the following:
 - 1. Insulated, architectural precast concrete units.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide architectural precast concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated:
 - 1. Loads: As indicated.
 - 2. Design framing system and connections to maintain clearances at openings, to allow for fabrication and construction tolerances, to accommodate live-load deflection, shrinkage and creep of primary building structure, and other building movements as follows:
 - a. Upward and downward movement of 1 inch.
 - 3. Thermal Movements: Provide for in-plane thermal movements resulting from annual ambient temperature changes of 120 deg F.
 - 4. Fire-Resistance Rating: Select material and minimum thicknesses to provide 2 - hour fire rating where indicated on Drawings.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
 - 2. Product Data for Credit MR 5: Product data for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

- C. Design Mixtures: For each precast concrete mixture. Include compressive strength and water-absorption tests.
- D. Shop Drawings: Detail fabrication and installation of architectural precast concrete units. Indicate locations, plans, elevations, dimensions, shapes, and cross sections of each unit. Indicate joints, reveals, and extent and location of each surface finish. Indicate details at building corners.
 - 1. Indicate separate face and backup mixture locations and thicknesses.
 - 2. Indicate welded connections by AWS standard symbols. Detail loose and cast-in hardware and connections.
 - 3. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
 - 4. Indicate locations, extent, and treatment of dry joints if two-stage casting is proposed.
 - 5. Include plans and elevations showing unit location and sequence of erection for special conditions.
 - 6. Indicate location of each architectural precast concrete unit by same identification mark placed on panel.
 - 7. Indicate relationship of architectural precast concrete units to adjacent materials.
 - 8. Design Modifications: If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.
 - 9. Comprehensive engineering analysis signed and sealed by the qualified professional engineer responsible for its preparation. Show governing panel types, connections, and types of reinforcement, including special reinforcement. Indicate location, type, magnitude, and direction of loads imposed on the building structural frame from architectural precast concrete.
- E. Samples: For each type of finish indicated on exposed surfaces of architectural precast concrete units, in sets of 3, illustrating full range of finish, color, and texture variations expected; approximately 12 by 12 by 2 inches.
 - 1. When other faces of precast concrete unit are exposed, include Samples illustrating workmanship, color, and texture of backup concrete as well as facing concrete.
- F. Reports: Submit Isothermal and Dew Point analyses for the precast panel envelope.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and fabricator.
- B. Source quality-control test reports.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A precast concrete erector qualified and designated by PCI's Certificate of Compliance to erect Category S2 (Complex Structural Systems) for load-bearing members.

- B. Fabricator Qualifications: A firm that assumes responsibility for engineering architectural precast concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
1. Participates in PCI's plant certification program and is designated a PCI-certified plant for Group A, Category A1 - Architectural Cladding and Load Bearing Units or participates in APA's "Plant Certification Program for Production of Architectural Precast Concrete Products" and is designated an APA-certified plant.
- C. Design Standards: Comply with ACI 318 and design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of architectural precast concrete units indicated.
- D. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."
- E. Welding: Qualify procedures and personnel according to AWS D1.1/D.1.1M, "Structural Welding Code - Steel"; and AWS D1.4, "Structural Welding Code - Reinforcing Steel."
- F. Calculated Fire-Test-Response Characteristics: Where indicated, provide architectural precast concrete units whose fire resistance has been calculated according to PCI MNL 124, "Design for Fire Resistance of Precast Prestressed Concrete," and is acceptable to authorities having jurisdiction.
- G. Sample Panels: After sample approval and before fabricating architectural precast concrete units, produce a minimum of 2 sample panels approximately 16 sq. ft. in area for review by Architect. Incorporate full-scale details of architectural features, finishes, textures, and transitions in sample panels.
1. Locate panels where indicated or, if not indicated, as directed by Architect.
 2. Damage part of an exposed-face surface for each finish, color, and texture, and demonstrate adequacy of repair techniques proposed for repair of surface blemishes.
 3. After acceptance of repair technique, maintain one sample panel at manufacturer's plant and one at Project site in an undisturbed condition as a standard for judging the completed Work.
 4. Demolish and remove sample panels when directed.
- H. Mockups: After sample panel and range sample approval but before production of architectural precast concrete units, construct full-sized mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Build mockup complete with anchors, connections, flashings, and joint fillers.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents unless such deviations are specifically approved by Architect in writing.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver architectural precast concrete units in such quantities and at such times to limit unloading units temporarily on the ground.
- B. Support units during shipment on nonstaining shock-absorbing material.
- C. Store units with adequate dunnage and bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.
- D. Place stored units so identification marks are clearly visible, and units can be inspected.
- E. Handle and transport units in a position consistent with their shape and design in order to avoid excessive stresses which would cause cracking or damage.
- F. Lift and support units only at designated points shown on Shop Drawings.

1.8 SEQUENCING

- A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

1.9 TESTING AND INSPECTION

- A. Special Inspection and Testing:
 - 1. In accordance with Chapter 17 of the 2003 International Building Code, the Owner shall employ a Special Inspection Agency to perform the duties and responsibilities specified in Section 1704.0 of the International Building Code.
 - 2. Refer to architectural, civil, mechanical, and electrical specifications for testing and inspection requirements of non-structural components.
 - 3. Work performed on the premises of a fabricator approved by the building official need not be tested and inspected per the table below. The fabricator shall submit a certificate of compliance that the work has been performed in accordance with the approved plans and specification to the building official and the Architect and Engineer of Record.
 - 4. Duties of the Special Inspection Agency:
 - a. Perform all testing and inspection required per approved testing and inspection program.
 - b. Furnish inspection reports to the building official, the Owner, the Architect, the Engineer of Record, and the Contractor. The reports shall be completed and furnished within 48 hours of inspected work.
 - c. Submit a final signed report stating whether the work requiring special inspection was, to the best of the Special Inspection Agency's knowledge in conformance with the approved plans and specifications.
 - 5. Structural Component Testing and Inspection Schedule for 03 45 00 is as follows:

	Continuous	Periodic	Referenced Standard	IBC Reference
Structural Precast Concrete				
Inspection of fabricators and during fabrication		X		1704.2
Review of Proposed Mix Design and Supporting Test Results		X		
Inspection of prestressed concrete				
A. Application of prestressing forces	X		ACI 318: 18.20	
B. Grouting of bonded prestressing tendons in the seismic-force resisting system	X		ACI 318: 18.18.4	
Erection of precast concrete members		X	ACI 318: Ch. 16	

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Fabricators: Subject to compliance with requirements, fabricators offering products that may be incorporated into the Work include, but are not limited to, the following:
1. ATMI Precast: Aurora, IL; 1-630-896-4679.
 2. AVAN Precast Concrete Products: Lynwood, IL; 1-708-757-6200.
 3. County Materials Corporation: Salem, IL; 1-618-549-1190.
 4. Lombard Architectural Precast Products Co.: Alsip, IL; 1-708-389-1060.
 5. Mid-States Concrete Industries: South Beloit, IL; 1-608-364-1072.
- B. Plant Certification: Fabricator must have current PCI plant certification according to MNL-117, Quality Control for Plants and Production of Architectural Precast Concrete Products, for category A1 - Architectural Precast Concrete Products.

2.2 MOLD MATERIALS

- A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that will provide continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.
1. Mold-Release Agent: Commercially produced liquid-release agent that will not bond with, stain or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.

2.3 REINFORCING MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- C. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

- D. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60, deformed bars, assembled with clips.
- E. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from galvanized steel wire into flat sheets.
- F. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.
- G. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 117.

2.4 PRESTRESSING TENDONS

- A. Prestressing Strand: ASTM A 416/A 416M, Grade 270, uncoated, 7-wire, low-relaxation strand.

2.5 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I or Type III, gray, unless otherwise indicated.
 - 1. For surfaces exposed to view in finished structure, mix gray with white cement, of same type, brand, and mill source.
- B. Supplementary Cementitious Materials:
 - 1. Fly Ash: ASTM C 618, Class C or F, with maximum loss on ignition of 3 percent.
 - 2. Metakaolin Admixture: ASTM C 618, Class N.
 - 3. Silica Fume Admixture: ASTM C 1240, with optional chemical and physical requirement.
 - 4. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- C. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.
 - 1. Face-Mixture-Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.
 - 2. Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand of same material as coarse aggregate, unless otherwise approved by Architect.
- D. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.
- E. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
- F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.
 - 1. Water-Reducing Admixtures: ASTM C 494/C 494M, Type A.

2. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
3. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.

2.6 STEEL CONNECTION MATERIALS

- A. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.
- B. Carbon-Steel-Headed Studs: ASTM A 108, AISI 1018 through AISI 1020, cold finished, AWS D1.1/D1.1M, Type A or B, with arc shields and with minimum mechanical properties of PCI MNL 117, Table 3.2.3.
- C. Carbon-Steel Plate: ASTM A 283/A 283M.
- D. Malleable Iron Castings: ASTM A 47/A 47M.
- E. Carbon-Steel Castings: ASTM A 27/A 27M, Grade 60-30.
- F. High-Strength, Low-Alloy Structural Steel: ASTM A 572/A 572M.
- G. Wrought Carbon-Steel Bars: ASTM A 675/A 675M, Grade 65.
- H. Deformed-Steel Wire or Bar Anchors: ASTM A 496 or ASTM A 706/A 706M.
- I. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A; carbon-steel, hex-head bolts and studs; carbon-steel nuts, ASTM A 563; and flat, unhardened steel washers, ASTM F 844.
- J. Zinc-Coated Finish: For exterior steel items, steel in exterior walls, and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A 123/A 123M or ASTM A 153/A 153M.
 1. For steel shapes, plates, and tubing to be galvanized, limit silicon content of steel to less than 0.03 percent or to between 0.15 and 0.25 percent or limit sum of silicon and 2.5 times phosphorous content to 0.09 percent.
 2. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035A or SSPC-Paint 20.
- K. Shop-Primed Finish: Prepare surfaces of nongalvanized steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 3 and shop-apply lead- and chromate-free, rust-inhibitive primer, complying with performance requirements in MPI 79 according to SSPC-PA 1.
- L. Welding Electrodes: Comply with AWS standards.

2.7 BEARING PADS

- A. Provide one of the following bearing pads for architectural precast concrete units as recommended by precast fabricator for application:
 1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, Type A durometer hardness of 50 to 70, ASTM D 2240, minimum tensile strength 2250 psi, ASTM D 412.

2. Random-Oriented, Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Type A durometer hardness of 70 to 90, ASTM D 2240; capable of supporting a compressive stress of 3000 psi with no cracking, splitting, or delaminating in the internal portions of pad. Test one specimen for every 200 pads used in Project.
3. Frictionless Pads: Tetrafluoroethylene (Teflon), glass-fiber reinforced, bonded to stainless or mild-steel plate, of type required for in-service stress.
4. High-Density Plastic: Multimonomer, nonleaching, plastic strip.

2.8 ACCESSORIES

- A. Precast Accessories: Provide clips, hangers, plastic or steel shims, and other accessories required to install architectural precast concrete units.

2.9 GROUT MATERIALS

- A. Sand-Cement Grout: Portland cement, ASTM C 150, Type I, and clean, natural sand, ASTM C 144 or ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

2.10 INSULATED PANEL ACCESSORIES

- A. Molded-Polystyrene Board Insulation: ASTM C 578, Type II, 1.35 lb/cu. ft.; square edges; with R-value of 3.85 per inch.
- B. Polyisocyanurate Board Insulation: ASTM C 591, Type II, 2.5 lb/cu. ft. unfaced, with R-value of 6.5 per inch.
- C. Wythe Connectors: Glass-fiber and vinyl-ester polymer connectors; Polypropylene pin connectors; Stainless-steel pin connectors; or Bent galvanized reinforcing bars or galvanized welded wire trusses, manufactured to connect wythes of precast concrete panels.

2.11 CONCRETE MIXTURES

- A. Prepare design mixtures for each type of precast concrete required.
 1. Limit use of fly ash and silica fume to 20 percent of portland cement by weight; limit metakaolin and silica fume to 10 percent of portland cement by weight.
- B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at architectural precast concrete fabricator's option.
- C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 or PCI MNL 117 when tested according to ASTM C 1218/C 1218M.
- D. Normal-Weight Concrete Mixtures: Proportion face and backup mixtures by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
 1. Compressive Strength (28 Days): 5000 psi minimum.

2. Maximum Water-Cementitious Materials Ratio: 0.45.
- E. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to PCI MNL 117.
- F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.
- G. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

2.12 MOLD FABRICATION

- A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.
- B. Maintain molds to provide completed architectural precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.
 1. Form joints are not permitted on faces exposed to view in the finished work.
 2. Edge and Corner Treatment: Uniformly chamfered.

2.13 FABRICATION

- A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
 1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."
- B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing architectural precast concrete units to supporting and adjacent construction.
- C. Cast-in reglets, slots, holes, junction boxes, conduit, and other accessories in architectural precast concrete units as indicated on the Contract Drawings.
 1. Coordinate with other trade packages to verify final quantities, sizes, and locations of embedded device boxes, and their embedded conduit paths.
- D. Cast-in openings larger than 10 inches in any dimension. Do not drill or cut openings or prestressing strand without Architect's approval.
- E. Reinforcement: Comply with recommendations in PCI MNL 117 for fabricating, placing, and supporting reinforcement.
 1. Clean reinforcement of loose rust and mill scale, earth, and other materials that

- reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcing exceeds limits specified in ASTM A 775/A 775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
 3. Place reinforcement to maintain at least 3/4-inch minimum coverage. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
 4. Place reinforcing steel and prestressing strand to maintain at least 3/4-inch minimum concrete cover. Increase cover requirements for reinforcing steel to 1-1/2 inches when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
 5. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.
- F. Reinforce architectural precast concrete units to resist handling, transportation, and erection stresses.
- G. Comply with requirements in PCI MNL 117 and requirements in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
- H. Place face mixture to a minimum thickness after consolidation of the greater of 1 inch or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover specified.
- I. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units.
1. Place backup concrete mixture to ensure bond with face-mixture concrete.
- J. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air on surfaces. Use equipment and procedures complying with PCI MNL 117.
1. Place self-consolidating concrete without vibration according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants."
- K. Comply with PCI MNL 117 for hot- and cold-weather concrete placement.
- L. Identify pickup points of architectural precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each architectural precast concrete unit on a surface that will not show in finished structure.
- M. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and

moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.

- N. Discard and replace architectural precast concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 117 and Architect's approval.

2.14 INSULATED PANEL CASTING

- A. Cast and screed supported wythe over mold.
- B. Place insulation boards abutting edges and ends of adjacent boards. Insert wythe connectors through insulation, and consolidate concrete around connectors according to connector manufacturer's written instructions.
- C. Cast and screed top wythe to meet required finish.

2.15 FABRICATION TOLERANCES

- A. Fabricate architectural precast concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished panel complies with the following product tolerances per PCI MNL 117:
 - 1. Overall Height and Width of Units, Measured at the Face Exposed to View: As follows:
 - a. 10 feet or under, plus or minus 1/8 inch.
 - b. 10 to 20 feet, plus 1/8 inch, minus 3/16 inch.
 - c. 20 to 40 feet, plus or minus 1/4 inch.
 - d. Each additional 10 feet, plus or minus 1/16 inch.
 - 2. Overall Height and Width of Units, Measured at the Face Not Exposed to View: As follows:
 - a. 10 feet or under, plus or minus 1/4 inch.
 - b. 10 to 20 feet, plus 1/4 inch, minus 3/8 inch.
 - c. 20 to 40 feet, plus or minus 3/8 inch.
 - d. Each additional 10 feet, plus or minus 1/8 inch.
 - 3. Total Thickness or Flange Thickness: Plus 1/4 inch, minus 1/8 inch.
 - 4. Variation from Square or Designated Skew (Difference in Length of the Two Diagonal Measurements): Plus or minus 1/8 inch per 72 inches or 1/2 inch total, whichever is greater.
 - 5. Length and Width of Block-outs and Openings within One Unit: Plus or minus 1/4 inch.
 - 6. Location and Dimension of Block-outs Hidden from View and Used for HVAC and Utility Penetrations: Plus or minus 3/4 inch.
 - 7. Dimensions of Haunches: Plus or minus 1/4 inch.
 - 8. Haunch Bearing Surface Deviation from Specified Plane: Plus or minus 1/8 inch.
 - 9. Difference in Relative Position of Adjacent Haunch Bearing Surfaces from Specified Relative Position: Plus or minus 1/4 inch.
 - 10. Bowing: Plus or minus L/360, maximum 1 inch.
 - 11. Local Smoothness: 1/4 inch per 10 feet.

12. Warping: 1/16 inch per 12 inches of distance from nearest adjacent corner.
 13. Tipping and Flushness of Plates: Plus or minus 1/4 inch.
 14. Dimensions of Architectural Features and Rustications: Plus or minus 1/8 inch.
- B. Position Tolerances: For cast-in items measured from datum line location, as indicated on Shop Drawings.
1. Weld Plates: Plus or minus 1 inch.
 2. Inserts: Plus or minus 1/2 inch.
 3. Handling Devices: Plus or minus 3 inches.
 4. Reinforcing Steel and Welded Wire Fabric: Plus or minus 1/4 inch where position has structural implications or affects concrete cover; otherwise, plus or minus 1/2 inch.
 5. Reinforcing Steel Extending out of Member: Plus or minus 1/2 inch of plan dimensions.
 6. Tendons: Plus or minus 1/4 inch, vertical; plus or minus 1 inch, horizontal.
 7. Location of Rustication Joints: Plus or minus 1/8 inch.
 8. Location of Opening within Panel: Plus or minus 1/4 inch.
 9. Location of Flashing Reglets at Edge of Panel: Plus or minus 1/8 inch.
 10. Reglets for Glazing Gaskets: Plus or minus 1/8 inch.
 11. Electrical Outlets, Hose Bibs: Plus or minus 1/2 inch.
 12. Location of Bearing Surface from End of Member: Plus or minus 1/4 inch.
 13. Allowable Rotation of Plate, Channel Inserts, and Electrical Boxes: 2-degree rotation or 1/4 inch maximum over the full dimension of unit.
 14. Position of Sleeve: Plus or minus 1/2 inch.

2.16 FINISHES

- A. Panel faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints shall be uniform, straight, and sharp. Finish exposed-face surfaces of architectural precast concrete units to match approved sample panels and as follows:
1. As-Cast Surface Finish: Provide surfaces free of pockets, sand streaks, and honeycombs.
- B. Finish exposed top, bottom, jambs, and back surfaces of architectural precast concrete units by smooth, steel-trowel finish.
- C. Finish unexposed surfaces of architectural precast concrete units by float finish.

2.17 PANEL TYPE DESCRIPTIONS

- A. Precast Panel: Thermally-broken, insulated panel.
1. Overall thickness: 12 inches.
 2. Insulation R-Value and Type: R-20 minimum for exterior panels, and those portions of interior panels exposed to exterior. Provide polyisocyanurate or molded-polystyrene board as required to provide necessary structural backing depth.
 3. Wythe connector: Delta ties or pins.
 4. Finishes:
 - a. Exterior: As-cast smooth, ready for priming and painting.

- b. Interior (Field House): Smooth steel trowel, ready for priming and painting.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Do not install precast concrete units until supporting cast-in-place building structural framing has attained minimum allowable design compressive strength or supporting steel or other structure is complete.

3.2 INSTALLATION

- A. Install clips, hangers, bearing pads, and other accessories required for connecting architectural precast concrete units to supporting members and backup materials.
- B. Erect architectural precast concrete level, plumb, and square within specified allowable tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment as units are being permanently connected.
 - 1. Install temporary steel or plastic spacing shims or bearing pads as precast concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
 - 2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
 - 3. Remove projecting lifting devices and grout fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
 - 4. Unless otherwise indicated, maintain uniform joint widths of 3/4 inch.
- C. Connect architectural precast concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.
 - 1. Do not permit connections to disrupt continuity of roof flashing.
- D. Welding: Comply with applicable AWS D1.1/D1.1M and AWS D1.4 for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.
 - 1. Protect architectural precast concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.
 - 2. Welds not specified shall be continuous fillet welds, using no less than the minimum fillet as specified by AWS.
 - 3. Clean weld-affected metal surfaces with chipping hammer followed by brushing, and apply a minimum 4.0-mil- thick coat of galvanized repair paint to galvanized surfaces according to ASTM A 780.

4. Clean weld-affected metal surfaces with chipping hammer followed by brushing, and reprime damaged painted surfaces.
 5. Remove, reweld, or repair incomplete and defective welds.
- E. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.
1. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot. For friction connections, apply specified bolt torque and check 25 percent of bolts at random by calibrated torque wrench.
- F. Grouting Connections: Grout connections where required or indicated. Retain grout in place until hard enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.

3.3 ERECTION TOLERANCES

- A. Erect architectural precast concrete units level, plumb, square, and true, without exceeding the following noncumulative erection tolerances:
1. Plan Location from Building Grid Datum: Plus or minus 1/2 inch.
 2. Plan Location from Centerline of Steel: Plus or minus 1/2 inch.
 3. Top Elevation from Nominal Top Elevation: As follows:
 - a. Exposed Individual Panel: Plus or minus 1/4 inch.
 - b. Non-Exposed Individual Panel: Plus or minus 1/2 inch.
 - c. Exposed Panel Relative to Adjacent Panel: 1/4 inch.
 - d. Non-Exposed Panel Relative to Adjacent Panel: 1/2 inch.
 4. Support Elevation from Nominal Support Elevation: As follows:
 - a. Maximum Low: 1/2 inch.
 - b. Maximum High: 1/4 inch.
 5. Maximum Plumb Variation over the Lesser of Height of Structure or 100 Feet: 1 inch.
 6. Plumb in Any 10 Feet of Element Height: 1/4 inch.
 7. Maximum Jog in Alignment of Matching Edges: 1/4 inch.
 8. Joint Width (Governs over Joint Taper): Plus or minus 1/4 inch.
 9. Maximum Joint Taper: 3/8 inch.
 10. Joint Taper in 10 Feet: 1/4 inch.
 11. Maximum Jog in Alignment of Matching Faces: 1/4 inch.
 12. Differential Bowing or Camber, as Erected, between Adjacent Members of Same Design: 1/4 inch.
 13. Opening Height between Spandrels: Plus or minus 1/4 inch.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and

inspections and prepare test reports.

- B. Field welds will be subject to visual inspections and nondestructive testing according to ASTM E 165 or ASTM E 709. High-strength bolted connections will be subject to inspections.
- C. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.5 REPAIRS

- A. Repair architectural precast concrete units if permitted by Architect. The Architect reserves the right to reject repaired units that do not comply with requirements.
- B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet.
- C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780.
- D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.
- E. Remove and replace damaged architectural precast concrete units when repairs do not comply with requirements.

3.6 CLEANING

- A. Clean surfaces of precast concrete units exposed to view.
- B. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.
- C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
 - 1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Clean soiled precast concrete surfaces with detergent and water, using stiff fiber brushes and sponges, and rinse with clean water. Protect other work from staining or damage due to cleaning operations.
 - 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION 03 45 00

SECTION 03 54 16 - HYDRAULIC CEMENT UNDERLAYMENT

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 hydraulic-cement-based, polymer-modified, self-leveling underlayment for application below interior floor coverings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.2: For priming and sealing coatings, documentation including printed statement of VOC content.
- C. Shop Drawings: Include plans indicating substrates, locations, and average depths of underlayment based on survey of substrate conditions.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment products required for this Project.
- B. Product Compatibility: Manufacturers of underlayment and floor-covering systems certify in writing that products are compatible.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.
 - 1. Place hydraulic-cement-based underlayments only when ambient temperature

and temperature of substrates are between 50 and 80 deg F.

1.7 COORDINATION

- A. Coordinate application of underlayment with requirements of floor-covering products and adhesives, to ensure compatibility of products.

PART 2 - PRODUCTS

2.1 HYDRAULIC-CEMENT-BASED UNDERLAYMENTS

- A. Underlayment: Hydraulic-cement-based, polymer-modified, self-leveling product that can be applied in minimum uniform thickness of 1/4 inch and that can be feathered at edges to match adjacent floor elevations.
 - 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. Ardex; K-15 Self-Leveling Underlayment Concrete.
 - b. CGM, Incorporated; PRO S.L.U. Self-Leveling Underlayment.
 - c. MAPEI Corporation; Ultraplan 1 Plus.
 - 2. Cement Binder: ASTM C 150, portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C 219.
 - 3. Compressive Strength: Not less than 4000 psi at 28 days when tested according to ASTM C 109/C 109M.
- B. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch; or coarse sand as recommended by underlayment manufacturer.
 - 1. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.
- C. Water: Potable and at a temperature of not more than 70 deg F.
- D. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.
 - 1. Primer shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for conditions affecting performance.
 - 1. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Prepare and clean substrate according to manufacturer's written instructions.
 - 1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
 - 2. Fill substrate voids to prevent underlayment from leaking.
- B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.
 - 1. Moisture Testing: Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates do not exceed a maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
- C. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.

3.3 APPLICATION

- A. General: Mix and apply underlayment components according to manufacturer's written instructions.
 - 1. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.
 - 2. Coordinate application of components to provide optimum underlayment-to-substrate and intercoat adhesion.
- B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- C. Apply underlayment to produce uniform, level surface.
 - 1. Apply a final layer without aggregate to product surface.
 - 2. Feather edges to match adjacent floor elevations.
- D. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.
- E. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.
- F. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

3.4 PROTECTION

- A. Protect underlayment from concentrated and rolling loads for remainder of construction period.

END OF SECTION 03 54 16

SECTION 04 20 00 - UNIT MASONRY

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. Concrete masonry units.
2. Decorative concrete masonry units (also referred to as Ground Face CMU.)
3. High Density Pre-Finished Concrete Masonry Units (also referred to as Stone Masonry.)
4. Mortar and grout.
5. Steel reinforcing bars.
6. Masonry joint reinforcement.
7. Ties and anchors.
8. Embedded flashing.
9. Miscellaneous masonry accessories.
10. Masonry-cell insulation.

B. Related Sections:

1. Section 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
2. Section 055000 "Metal Fabrications" for furnishing steel lintels and for unit masonry.
3. Section 076200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.3 DEFINITIONS

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

1.4 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
 1. Concrete Masonry Unit Test: For each type of unit required, according to ASTM C 140 for compressive strength.

2. Mortar Test (Property Specification): For each mix required, according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
3. Mortar Test (Property Specification): For each mix required, according to ASTM C 780 for compressive strength.
4. Grout Test (Compressive Strength): For each mix required, according to ASTM C 1019.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 1. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
- C. Shop Drawings: For the following:
 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
- D. Samples for Verification: For each type and color of the following:
 1. Decorative CMUs.
 2. High Density Pre-Finished Concrete Masonry Units.

1.6 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each type and size of the following:
 1. Masonry units.
 - a. Include material test reports substantiating compliance with requirements.
 - b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
 2. Cementitious materials. Include brand, type, and name of manufacturer.
 3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 4. Grout mixes. Include description of type and proportions of ingredients.
 5. Reinforcing bars.
 6. Joint reinforcement.
 7. Anchors, ties, and metal accessories.
- B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- C. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Build mockup of typical wall area as shown on Drawings.
 2. Build mockups for typical exterior wall in sizes approximately 60 inches long by 48 inches high by full thickness, including face and backup wythes and accessories.
 - a. Include a sealant-filled joint at least 16 inches long in exterior wall mockup.
 - b. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
 - c. Include metal studs, sheathing, air barrier, veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.
 3. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
 4. Protect accepted mockups from the elements with weather-resistant membrane.
 5. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
 - a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
 - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.
- C. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
 - 2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.
- B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

- A. Regional Materials: CMUs shall be manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - 2. Provide bullnose units for outside corners unless otherwise indicated.
- C. CMUs: ASTM C 90.
 - 1. Density Classification: Normal weight.
 - 2. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
- D. Decorative CMUs (also referred to as Ground Face CMU on Drawings): ASTM C 90.
 - 1. Products: Subject to compliance with requirements, provide Trendwyth; Trendstone ground face masonry units.
 - a. Color 1: Almond Bark.
 - b. Color 2: Haydite.
 - c. Color 3: Midwest Slate.
 - 2. Density Classification: Normal weight.
 - 3. Size (Width): Manufactured to dimensions specified in "CMUs" Paragraph.
- E. High Density Pre-Finished Concrete Masonry Units (also referred to as Stone Masonry on Drawings):
 - 1. Subject to compliance with requirements, provide one of the following:
 - a. Cordova Stone; color: Limestone, groundface finish.
 - b. Reading Rock Inc; RockCast Architectural Masonry Veneer, color:

Riesling, smooth finish.

2. Sizes (Nominal):
 - a. 8 in. height by 24 in. wide by 4 in. depth.
 - b. 4 in. height by 24 in. wide by 4 in. depth, for use at recessed band.
 - c. Custom cast shapes and profiles as required to provide 8 in. returns at corners and jambs, and sloped extended sill profiles for windows and transition to zinc composite panel system.

2.3 MASONRY LINTELS

- A. General: Provide one of the following:
- B. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.4 MORTAR AND GROUT MATERIALS

- A. Regional Materials: Aggregate for mortar and grout[, cement, and lime] shall be extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- C. Hydrated Lime: ASTM C 207, Type S.
- D. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- E. Colored Cement Product: Packaged blend made from portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.
 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. Colored Portland Cement-Lime Mix:
 - 1) Capital Materials Corporation; Riverton Portland Cement Lime Custom Color.
 - 2) Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
 - 3) Lafarge North America Inc.; Eaglebond Portland & Lime.
 - 4) Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.
 2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.

3. Pigments shall not exceed 10 percent of portland cement by weight.
- F. Aggregate for Mortar: ASTM C 144.
1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
 3. White-Mortar Aggregates: Natural white sand or crushed white stone.
- G. Aggregate for Grout: ASTM C 404.
- H. Epoxy Pointing Mortar: ASTM C 395, epoxy-resin-based material formulated for use as pointing mortar for structural-clay tile facing units (and approved for such use by manufacturer of units); in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's colors.
- I. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
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. Euclid Chemical Company (The); Accelguard 80.
 - b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
 - c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.
- J. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent by same manufacturer.
1. For use with high density pre-finished concrete masonry units.
 2. Products: Subject to compliance with requirements, provide the following:
 - a. ACM Chemistries; RainBloc for Mortar.
- K. Water: Potable.

2.5 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.
- B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
1. Interior Walls: [Mill-] [Hot-dip] galvanized, carbon steel.
 2. Exterior Walls: Hot-dip galvanized, carbon steel.
 3. Wire Size for Side Rods: 0.187-inch diameter.
 4. Wire Size for Cross Rods: 0.187-inch diameter.
 5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
 6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
- C. Masonry Joint Reinforcement for Multiwythe Masonry:

1. Ladder type with 1 side rod at each face shell of hollow masonry units more than 4 inches wide, plus 2 side rods at each wythe of masonry 4 inches wide or less.

2.6 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
 1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 641/A 641M, Class 1 coating.
 2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
- B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.
- C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.
 1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units.
 2. Where wythes do not align or are of different materials, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.
 3. Wire: Fabricate from 3/16-inch- diameter, hot-dip galvanized steel wire. Mill-galvanized wire ties may be used in interior walls unless otherwise indicated.
- D. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch-diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.
 2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.187-inch- diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.
- E. Partition Top anchors: 0.105-inch- thick metal plate with 3/8-inch- diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
- F. Adjustable Masonry-Veneer Anchors:
 1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
 - a. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.
 2. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.

- a. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:
 - 1) Heckmann Building Products Inc.; Pos-I-Tie.
 - 2) Fero, Inc.; Slotted Stud Tie - Type II.
 - 3) Hohmann & Barnard, Inc.; X-Seal Anchor.
 - b. Anchor Section: Corrosion-resistant, self-drilling, eye-screw designed to receive wire tie. Eye-screw has spacer that seats directly against framing and is same thickness as sheathing and has gasketed, washer head that covers hole in sheathing.
 - c. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.187-inch- diameter, hot-dip galvanized steel wire.
3. Stainless-Steel Drill Screws for Steel Studs: Proprietary fastener consisting of carbon-steel drill point and 300 Series stainless-steel shank, complying with ASTM C 954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads.
- a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Dayton Superior Corporation, Dur-O-Wal Division; Stainless Steel SX Fastener.
 - 2) ITW Buildex; Scots long life Tekes.

2.7 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with Section 076200 "Sheet Metal Flashing and Trim" and as follows:
 - 1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch thick.
 - 2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
 - 3. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
 - 4. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
 - 5. Metal Drip Edge: Fabricate from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
- B. Flexible Flashing: Use the following unless otherwise indicated:
 - 1. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 inch.

- a. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:
 - 1) Advanced Building Products Inc.; Peel-N-Seal.
 - 2) Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
 - 3) Dayton Superior Corporation, Dur-O-Wal Division; Dur-O-Barrier Thru-Wall Flashing.
 - 4) Grace Construction Products, W. R. Grace & Co. - Conn.; Perm-A-Barrier Wall Flashing.
 - 5) Heckmann Building Products Inc.; No. 82 Rubberized-Asphalt Thru-Wall Flashing.
 - 6) Hohmann & Barnard, Inc.; Textroflash.
 - 7) W. R. Meadows, Inc.; Air-Shield Thru-Wall Flashing.
 - b. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.
- C. Application: Unless otherwise indicated, use the following:
- 1. Where flashing is indicated to receive counterflashing, use metal flashing.
 - 2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
 - 3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge or flexible flashing with a metal drip edge.
 - 4. Where flashing is fully concealed, use flexible flashing.
- D. Solder and Sealants for Sheet Metal Flashings:
- 1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
 - 2. Elastomeric Sealant: ASTM C 920, chemically curing silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.8 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

- D. Weep/Vent Products: Use the following unless otherwise indicated:
1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.
 - a. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:
 - 1) Advanced Building Products Inc.; Mortar Maze weep vent.
 - 2) Blok-Lok Limited; Cell-Vent.
 - 3) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
 - 4) Heckmann Building Products Inc.; No. 85 Cell Vent.
 - 5) Hohmann & Barnard, Inc.; Quadro-Vent.
 - 6) Wire-Bond; Cell Vent.
- E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
1. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. Advanced Building Products Inc.; [Mortar Break] [Mortar Break II].
 - b. Archovations, Inc.; CavClear Masonry Mat.
 - c. Mortar Net USA, Ltd.; Mortar Net.
 2. Provide one of the following configurations:
 - a. Strips, full-depth of cavity and 10 inches high, with dovetail shaped notches 7 inches deep that prevent clogging with mortar droppings.
 - b. Strips, not less than 1-1/2 inches thick and 10 inches high, with dimpled surface designed to catch mortar droppings and prevent weep holes from clogging with mortar.
 - c. Sheets or strips not less than 1 inch thick and installed to full height of cavity with additional strips 4 inches high at weep holes and thick enough to fill entire depth of cavity and prevent weep holes from clogging with mortar.
- F. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
1. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
 - b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
 - c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.

- d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

2.9 MASONRY-CELL INSULATION

- A. Foam Injection Insulation: Provide one of the following:
 - 1. Applegate R Foam; C-Foam.
 - 2. Tailored Chemical Products, Inc.; Core-Fill 500.
 - 3. Thermal Corporation of America; Thermco Foam Insulation.
 - 4. Tripolymer Insulation; Foam-In-Place Insulation.

2.10 CAVITY-WALL INSULATION

- A. See Section 07 42 65 "Thermal and Air Barrier System" for cavity insulation product.

2.11 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. Diedrich Technologies, Inc.
 - b. EaCo Chem, Inc.
 - c. ProSoCo, Inc.
- B. For Decorative Concrete Masonry Units, and for High Density Pre-Finished Concrete Masonry Units, use product recommended by manufacturer.

2.12 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Use portland cement-lime mortar unless otherwise indicated.
 - 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification. Provide the

following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For reinforced masonry, use Type S.
 2. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
 3. For interior non-load-bearing partitions, Type O may be used instead of Type N.
- D. Pigmented Mortar: Use colored cement product.
1. Pigments shall not exceed 10 percent of portland cement by weight.
 2. Mix to match Architect's sample.
 3. Application: Use pigmented mortar for exposed mortar joints with the following units:
 - a. Decorative CMUs.
- E. Grout for Unit Masonry: Comply with ASTM C 476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 2. Verify that foundations are within tolerances specified.
 3. Verify that reinforcing dowels are properly placed.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
 - 1. Mix units from several pallets or cubes as they are placed.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

- 1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
- 2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
- 3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

- 1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
- 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
- 3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
- 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
- 5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
- 6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
- 7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

- 1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
- 2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
- 3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
- 4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.

5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond ; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
 1. For High Density Pre-Finished Concrete Masonry Units, lay masonry in bond pattern indicated on Drawings.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames for exterior doors and masonry solidly with mortar unless otherwise indicated.
 1. Coordinate with installation of security access infrastructure.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
 1. Install compressible filler in joint between top of partition and underside of structure above.
 2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
 3. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 07 84 46 "Fire-Resistive Joint Systems."

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 - 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 - 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Set trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
 - 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 - 2. Allow cleaned surfaces to dry before setting.
 - 3. Wet joint surfaces thoroughly before applying mortar.
- D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.6 CAVITY WALLS

- A. Bond wythes of cavity walls together using one of the following methods:
 - 1. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
 - a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
 - b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.
 - 2. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.
- B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
- C. Installing Cavity-Wall Insulation: See Section 07 42 65 "Thermal and Air Barrier System".

3.7 MASONRY-CELL INSULATION

- A. Install masonry foam insulation per manufacturer's written recommendations.

3.8 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
 - 1. Space reinforcement not more than 16 inches o.c.
 - 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
 - 3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.9 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:
 - 1. Provide an open space not less than 1/2 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 - 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
 - 3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.10 ANCHORING MASONRY VENEERS

- A. Anchor masonry veneers to concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:
 - 1. Fasten screw-attached anchors to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
 - 2. Embed tie sections in masonry joints. Provide not less than 2 inches of air space between back of masonry veneer and face of sheathing.

3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 16 inches o.c. vertically and 24 inches o.c. horizontally with not less than 1 anchor for each 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.

3.11 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:
 1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
 2. Install preformed control-joint gaskets designed to fit standard sash block.
 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
 4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.
- C. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 07 92 00 "Joint Sealants," but not less than 3/8 inch.
 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.12 LINTELS

- A. Install steel lintels for high density pre-finished concrete masonry units at exterior openings.
- B. Provide masonry lintels for CMU and Decorative CMU where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.
- C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.13 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.[Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.]
- B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 2. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
 3. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.
- C. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
1. Use specified weep/vent products to form weep holes.
 2. Space weep holes 24 inches o.c. unless otherwise indicated.
- D. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.
- E. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products to form vents.

3.14 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 2. Limit height of vertical grout pours to not more than 60 inches.

3.15 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

- B. Inspections: Level 1 special inspections according to the "International Building Code."
 - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 - 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 - 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
- G. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for [mortar air content] [and] [compressive strength].
- H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.16 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.17 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 20 00

SECTION 04 22 00 - CONCRETE UNIT MASONRY

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. Concrete masonry units.
2. Decorative concrete masonry units.
3. Mortar and grout.
4. Steel reinforcing bars.
5. Masonry joint reinforcement.
6. Ties and anchors.
7. Miscellaneous masonry accessories.

B. Related Sections:

1. Section 04 43 13.13 "Anchored Stone Masonry Veneer" for stone veneer units and anchors.
2. Section 05 12 00 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural-steel frame.
3. Section 076200 "Sheet Metal Flashing and Trim" for sheet metal flashing.

1.3 DEFINITIONS

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

1.4 PERFORMANCE REQUIREMENTS

- A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.
 1. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

1.5 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

1. Prism Test: For each type of construction required, according to ASTM C 1314.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 1. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
- C. Shop Drawings: For the following:
 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
- D. Samples for Initial Selection:
 1. Decorative CMUs, in the form of small-scale units.
 2. Colored mortar.
- E. Samples for Verification: For each type and color of the following:
 1. Decorative CMUs.
 2. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project.

1.7 INFORMATIONAL SUBMITTALS

- A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
 1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.
- B. Material Certificates: For each type and size of the following:
 1. Masonry units.
 - a. Include material test reports substantiating compliance with requirements.
 - b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.

2. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 3. Grout mixes. Include description of type and proportions of ingredients.
 4. Reinforcing bars.
 5. Joint reinforcement.
- C. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- D. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.8 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Build mockup of typical wall area as shown on Drawings.
 2. Build mockups for typical exterior wall in sizes approximately 72 inches long by 48 inches high by full thickness, including face and backup wythes and accessories.
 - a. Include a sealant-filled joint at least 16 inches long in exterior wall mockup.
 - b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches wide by 16 inches high.
 - c. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
 3. Protect accepted mockups from the elements with weather-resistant membrane.
 4. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.

- a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
- b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.10 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
- B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 2. Protect sills, ledges, and projections from mortar droppings.
 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.
- B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

- A. Regional Materials: CMUs shall be manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 2. Provide bullnose units for outside corners unless otherwise indicated.
- C. CMUs: ASTM C 90.
1. Density Classification: Normal weight.
 2. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
- D. Decorative CMUs: ASTM C 90.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. <Insert, in separate subparagraphs, manufacturer's name; product name or designation>.
 2. Density Classification: Normal weight.
 3. Size (Width): Manufactured to dimensions specified in "CMUs" Paragraph.
 4. Pattern and Texture:
 - a. Standard pattern, ground-face finish.

5. Colors: As indicated by manufacturer's designations.

2.3 MASONRY LINTELS

- A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.4 MORTAR AND GROUT MATERIALS

- A. Regional Materials: Aggregate for mortar and grout[, cement, and lime] shall be extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- C. Hydrated Lime: ASTM C 207, Type S.
- D. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- E. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.
 1. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. Davis Colors; True Tone Mortar Colors.
 - b. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
 - c. Solomon Colors, Inc.; SGS Mortar Colors.
 - d. <Insert manufacturer's name; product name or designation>.
- F. Aggregate for Mortar: ASTM C 144.
 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
 3. White-Mortar Aggregates: Natural white sand or crushed white stone.
 4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- G. Aggregate for Grout: ASTM C 404.
- H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

- I. Water: Potable.

2.5 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.
- B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
 - 1. Interior Walls: Hot-dip galvanized, carbon steel.
 - 2. Exterior Walls: Hot-dip galvanized, carbon steel.
 - 3. Wire Size for Side Rods: 0.148-inch diameter.
 - 4. Wire Size for Cross Rods: 0.148-inch diameter.
 - 5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
 - 6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

2.6 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
 - 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
 - 2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
- B. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 - 1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch-diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.
 - 2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.187-inch- diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls, unless otherwise indicated.
- C. Partition Top anchors: 0.105-inch- thick metal plate with 3/8-inch- diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from urethane or PVC.

- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

2.8 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Use portland cement-lime mortar unless otherwise indicated.
 - 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
 - 1. For reinforced masonry, use [Type S] [Type N].
 - 2. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
 - 3. For interior non-load-bearing partitions, Type O may be used instead of Type N.
- C. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
 - 1. Application: Use pigmented mortar for exposed mortar joints with the following units:
 - a. Decorative CMUs.
- D. Grout for Unit Masonry: Comply with ASTM C 476.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 - 2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
 - 3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Build chases and recesses to accommodate items specified in this and other Sections.
- B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 TOLERANCES

- A. Dimensions and Locations of Elements:
 - 1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
 - 2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
 - 3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.
- B. Lines and Levels:
 - 1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
 - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.

4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
3. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 07 84 46 "Fire-Resistive Joint Systems."

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.6 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
1. Space reinforcement not more than 16 inches o.c.
 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
 3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.

3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:
 - 1. Provide an open space not less than 1/2 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 - 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
 - 3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.8 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:
 - 1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
 - 2. Install preformed control-joint gaskets designed to fit standard sash block.
 - 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.

3.9 LINTELS

- A. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.
- B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.10 REINFORCED UNIT MASONRY INSTALLATION

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

- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 - 1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 - 2. Limit height of vertical grout pours to not more than 60 inches.

3.11 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.
- B. Inspections: Level 1 special inspections according to the "International Building Code."
 - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 - 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 - 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- E. Prism Test: For each type of construction provided, according to ASTM C 1314 at 28 days.

3.12 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.13 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Excess Masonry Waste: Remove excess clean masonry waste and other masonry waste, and legally dispose of off Owner's property. See section 01 74 19 "Construction Waste Management and Disposal."

END OF SECTION 04 22 00

SECTION 05 12 23 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The General and Supplementary Conditions of the Construction Contract and Division 1 - General Requirements apply to the work specified in this section.
- B. This section includes fabrication and erection of structural steel work, as shown on the Drawings and specified herein. Work shall include, but not be limited to the following items:
 - 1. Structural steel
 - 2. Base and bearing plates.
 - 3. Deck support angles and framing for roof openings.
 - 4. Steel lintel members for masonry openings.
 - 5. Edge angles and bent plates.
 - 6. Connection plates.
 - 7. Shear stud connectors.
 - 8. All other steel items as listed in AISC – “Code of Standard Practice for Steel Buildings and Bridges” as shown on structural and architectural drawings.
- C. Work shall also include grouting of all structural steel members where indicated.
- D. Structural notes indicated on the drawings regarding structural steel framing should be considered a part of this specification.
- E. No substitutions will be allowed without the Engineer’s approval.

1.2 QUALITY ASSURANCE

- A. Codes and Standards: Comply with the provisions of the following codes, specifications, and standards except where more stringent requirements are shown or specified.
 - 1. AISC - Specification for Structural Joints Using ASTM A325 or A490 Bolts.
 - 2. AISC - Code of Standard Practice for Buildings and Bridges.
 - 3. AISC - Specification for the Design of Steel Hollow Structural Sections.
 - 4. AISC - Specification for Allowable Stress Design of Single-Angle Members or Specification for Load and Resistance Factor Design of Single-Angle Members.
 - 5. AISC 360-05 – Specification for Structural Steel Buildings – Allowable Strength Design, 13th Edition.
 - 6. ASTM A36 - Standard Specification for Carbon Structural Steel.
 - 7. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
 - 8. ASTM A108 - Standard Specification for Steel Bar, Carbon, Cold-Finished, Standard Quality.

9. ASTM A123 - Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
 10. ASTM A153 - Standard Specification for Zinc Coating (Hot Dip), on Iron and Steel Hardware.
 11. ASTM A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
 12. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
 13. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 14. ASTM A500 - Standard Specification for Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 15. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
 16. ASTM A572 - Standard Specification for High Strength, Low-Alloy Columbium-Vanadium Structural Steel.
 17. ASTM A992 - Standard Specification for Steel for Structural Shapes for use in Building Framing.
 18. ASTM A1085 - Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections.
 19. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
 20. ASTM F436 - Standard Specification for Hardened Steel Washers.
 21. ASTM F1554 - Standard Specification for Anchor Bolts, Steel 36, 55 and 105 ksi Yield Strength
 22. AWS D1.1 - Structural Welding Code.
 23. SSPC - Steel Structures Painting Council.
- B. Where any provisions of other pertinent codes and standards conflict with this specification, the more stringent provision shall govern.
- C. Fabrication, Erection, and Welding Qualifications:
1. Fabricate structural steel members in accordance with AISC Specification for the design, fabrication and erection of structural steel for buildings.
 2. Steel fabricator shall not have less than five (5) years of continuous experience in fabrication of structural steel framing.
 3. Steel erector shall not have less than five (5) years of continuous experience in the erection of structural steel framing.

4. All welding of structural steel shall be performed by operators who have been recently qualified as prescribed in "Qualification Procedures" of the American Welding Society (AWS).
- D. Tolerances: Tolerances shall be as indicated by the AISC Code of Standard Practice for Buildings and Bridges except that tolerances for fabricating, rolling, cambering and erection shall not be cumulative.

1.3 TESTING AND INSPECTION

A. Special Inspection and Testing:

1. In accordance with Chapter 17 of the International Building Code, the Owner shall employ a Special Inspection Agency to perform the duties and responsibilities specified in Section 1704.0 of the International Building Code.
2. Refer to architectural, civil, mechanical, and electrical specifications for testing and inspection requirements of non-structural components.
3. Work performed on the premises of a fabricator approved by the building official need not be tested and inspected per the table below. The fabricator shall submit a certificate of compliance that the work has been performed in accordance with the approved plans and specification to the building official and the Architect and Engineer of Record.
4. Duties of the Special Inspection Agency:
 - a. Perform all testing and inspection required per approved testing and inspection program.
 - b. Furnish inspection reports to the building official, the Owner, the Architect, the Engineer of Record, and the General Contractor. The reports shall be completed and furnished within 48 hours of inspected work.
 - c. Submit a final signed report stating whether the work requiring special inspection was, to the best of the Special Inspection Agency's knowledge in conformance with the approved plans and specifications.
5. Structural Component Testing and Inspection Schedule for Section 05 12 23 is as follows:

	Continuous	Periodic	Referenced Standard	IBC Reference
Structural Steel				
1. Material verification of high-strength bolts, nuts, and washers:			Applicable ASTM material specifications: AISC ASD Section A3.4, AISC LRFD Section A3.3	
A. Identification markings to conform to ASTM standards specified in the approved construction documents		X		

Structural Steel	Continuous	Periodic	Referenced Standard	IBC Reference
B. Manufacturer's certificate of compliance required		X		
2. Inspection of high-strength bolting:			AISC LRFD Section M2.5	1704.3.3
A. Bearing type connections		X		
B. Slip-critical connections including tension controlling bolting	X	X		
3. Material verification of structural steel				1708.4
A. Identification markings to conform to ASTM standards specified in the approved construction documents		X	ASTM A6 or ASTM A568	
B. Manufacturer's certified mill test reports required		X	ASTM A6 or ASTM A568	
4. Material verification of weld filler materials:			AISC ASD Section A3.6, AISC LRFD Section A3.5	
A. Identification markings to conform to ASTM standards specified in the approved construction documents		X		
B. Manufacturer's certificate of compliance required		X		
5. Inspection of welding:				
A. Complete and partial penetration groove welds	X		AWS D1.1	1704.3.1
B. Multi-pass fillet welds	X		AWS D1.1	1704.3.1
C. Single-pass fillet welds > 5/16" (7.9 mm)	X		AWS D1.1	1704.3.1
D. Single-pass fillet welds ≤ 5/16" (7.9 mm)		X	AWS D1.1	1704.3.1
E. Composite stud testing		X	AWS D1.1	
6. Inspection of steel frame joint details for compliance with approved construction documents				1704.3.2
A. Details such as bracing and stiffening		X		
B. Member locations		X		
C. Application of joint details at each connection		X		

1.4 SUBMITTALS

A. Shop Drawings:

1. Prepare and submit complete erection and detailed shop drawings for Engineer's approval, including framing plans indicating size, weight and location of all structural members. Shop drawings shall indicate methods of connecting, anchoring, fastening, bracing and attaching work of other trades.
 - a. Where contract documents indicate verify in field (VIF) dimensions, shop drawings shall indicate these dimensions and Contractor shall note that the dimensions have been verified.
 - b. This specification modifies AISC Code of Standard Practice by deleting the following sentence from 4.4.1(c): "Release by the Owner's Designated Representatives for Design and Construction for the Fabricator to begin fabrication using the approved submittals." Review of the shop drawings by the Engineer shall not relieve the fabricator of this responsibility.

2. Furnish both the Engineer and Architect with one copy of the following:
 - a. Final shop drawings containing all review notations.
 - b. Field Use/For Construction Drawings.
 3. The steel fabricator shall submit a setting plan for all embedded items for Engineer's approval.
 4. Welder's Certification: Submit certification for all welders employed on the project demonstrating they have been AWS qualified to perform the welding procedures required for this project.
 5. General Contractor/Construction Manager to provide copies of field concrete cylinder breaks indicating the concrete meets 75% of the design compressive strength to the steel erector.
- B. The General Contractor shall conduct a field survey of as-built anchors and bearing plate locations and elevations prior to steel erection. Survey shall be furnished to the steel fabricator. Contractor shall identify deviations from approved shop drawings and submit proposed repairs and modifications to the Engineer and steel fabricator for approval.
- C. Product Data:
1. Prepare and submit product data for Engineer's approval for shop applied primers, finished paint system, expansion and/or adhesive anchors, non-shrink grout and other miscellaneous materials.
- D. LEED Certification: Submit manufacturer's certification for each steel product including the following:
1. LEED Credit MRc 4.1/4.2 – Recycled content, including percentage of pre-consumer (post-industrial) and post consumer recycled content. Also provide manufacturer's name, product cost and steel processing furnace type.
 2. LEED Credit MRc 5.1/5.2 – Location of manufacturing plant, manufacturer's name, product cost and location of extraction or harvest of raw materials.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Steel members shall be transported, stored and erected in a manner that will avoid any damage or deformation. Materials should be stored to allow easy access for inspection and identification. Bent or deformed members will be rejected and shall be replaced or repaired at the expense of the responsible party. Store clear of the ground and in such a manner as to eliminate excessive handling.
- B. Store fasteners in a protected location. Clean and re-lubricate bolts and nuts before use.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Structural Steel:
 1. All structural steel shall be free from defects impairing strength, durability or appearance. All structural steel shall meet the latest minimum requirements as follows:

- a. Structural steel shapes, bars and plates shall conform to the ASTM designations listed in the General Notes of the Drawings.
 - b. Square and rectangular structural tubing shall be cold formed conforming to the ASTM designations listed in the General Notes of the Drawings.
 - c. Round structural tubing shall be cold formed conforming to the ASTM designations listed in the General Notes of the Drawings.
 - d. Steel pipe shall conform to the ASTM designations listed in the General Notes of the Drawings.
- B. High Strength Structural Bolts:
1. High strength structural bolts shall conform to the ASTM designations listed in the General Notes of the Drawings.
 2. High strength bolts shall be detailed and installed in accordance with AISC - "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
 3. Manufacturer's symbol and grade markings shall appear on all bolts and nuts.
- C. Anchoring Devices:
1. Anchor Rods: Anchor rods used with structural steel members shall be plain threaded rods conforming to the ASTM designations listed in the General Notes of the Drawings.
 2. Expansion Anchors: Expansion anchors shall consist of one-piece wedge type carbon steel anchors with heavy-duty nuts and washers. All components shall be zinc plated in accordance with ASTM B633. Refer to the drawing details and General Notes for the expansion anchors used as the basis of design and the acceptable alternates.
 3. Adhesive Anchoring System: Adhesive anchoring system shall consist of a threaded anchor rod complete with nut and washer and the adhesive cartridge. Refer to the drawing details and General Notes for the adhesive anchoring systems used as the basis of design and the acceptable alternates.
 - a. Nuts shall meet ASTM A563, Grade DH, and washers shall meet ASTM F436.
 - b. All components shall be zinc plated in accordance with ASTM B633 SC1.
 - c. Adhesive shall consist of a two-part acrylic based adhesive applied in a dual cartridge dispensing system that properly mixes the components at the point of application.
- D. Welding Materials:
1. Type required for material being welded in conformance with AWS D1.1.
- E. Stud Connectors:
1. For threaded studs that are being used to connect steel beams to embed plates, use ASTM A108, Type A, Grades 1010 through 1020 forged steel, headed

uncoated with a minimum tensile strength of 61,000 psi. Fabricated within the tolerances set forth in AWS D1.1.

2. For shear connectors that are being used on steel beams in concrete slabs for composite shear transfer and embedded steel members, use ASTM A108, Type B, Grades 1010 through 1020 forged steel, headed uncoated with a minimum tensile strength of 65,000 psi. Fabricated within the tolerances set forth in AWS D1.1
3. Studs applied by means of the electric arc welding process and shall use an arc shield ferrules of heat resistant ceramic.

F. Paints and Primers:

1. Fabricator's standard lead- and chromate-free, non-asphalitic, rust-inhibiting primer.
2. Galvanizing repair paint: SSPC Paint 20.
3. Refer to Specification Section 09 90 00 for additional paint requirements.

G. Non-Shrink Grout for Base and Bearing Plates: Non-shrink grout, conforming to ASTM C1107, shall be pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sand, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents. All constituents shall meet the requirements of these specifications. Minimum compressive strength at 28-days shall be 7,000 psi as determined by ASTM C109. Follow manufacturer's instructions for handling, mixing, placing and curing. Acceptable products are:

1. Euclid Chemical Company - Euco N.S. Grout
2. L&M Construction Chemical - Crystex.
3. Master Builders - Masterflow 713.
4. Sonneborn - Sonnogrout.
5. Five Star Products Inc. – Five Star Grout.
6. Dayton Superior - Sure-Grip High Performance Grout.
7. Dayton Superior – 1107 Advantage Grout.

2.2 FABRICATION AND MANUFACTURE

A. Fabrication Procedures:

1. Fabricate all structural steel items in accordance with AISC Specifications and as indicated on the drawings.
2. Provide camber in structural members where indicated.
3. Properly mark materials for field assembly. Fabricate for delivery sequence that will expedite erection and minimize handling of materials.
4. Complete structural steel assemblies before shop priming or galvanizing.

B. Shop Connections:

1. All shop connections shall be welded, unless noted otherwise on drawings. Connections shall develop the full strength of the adjoining members unless detailed otherwise.

2. All holes shall be either drilled or punched, as no burning of holes will be permitted, including the enlargement of holes. Provide all holes required for connections and for attaching the work of other trades where such holes are shown if furnished prior to fabrication.
 3. Connections shall be detailed as standard framed beam connections (bearing type) in accordance with the AISC Manual of Steel Construction - Allowable Stress Design. Connections which require oversized holes or slotted holes in which the force is other than normal to the axis of the slot shall be detailed as "Slip-Critical Connections" and noted as such on the erection drawings. Provide bearing plates and end anchorage for beams resting on masonry.
 4. All full and partial penetration welds shall be fully detailed on the shop drawings. Use backing for all full penetration welds.
 5. Weld access holes shall be fabricated in accordance with the recommendations of AWS D1.1 and AISC Specification.
- C. Shear Connectors:
1. Steel stud shear connectors shall be securely welded in the field to structural steel beams as detailed on the drawings. Welds shall be such that the shear connector stud will deform before weld failure occurs. Welding shall be done in accordance with AWS D1.1.
 2. Shear stud connector for embedded plates and angles shall be welded in the fabrication shop in accordance with AWS D1.1.
- D. Deck support framing and seats: Furnish all miscellaneous framing necessary to fully support the roof and floor steel decking.
- E. Shop Priming:
1. Unless noted otherwise below, structural steel shall not be shop primed.
 2. The following are steel surfaces to receive shop priming:
 - a. Surfaces outside the building envelope that are not galvanized, including the following:
 - 1) Covered canopies.
 - b. Surfaces to be painted per Architect's drawings.
 3. If the steel pieces are to be shop primed, the following surfaces are exceptions to shop priming:
 - a. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 - b. Surfaces to be field welded.
 - c. Surfaces to be high-strength bolted with slip-critical connections.
 - d. Top flanges of beams supporting composite steel decking.
 - e. Surfaces to receive sprayed fire-resistive materials.

- f. Galvanized surfaces.
 - 4. Surface Preparation: Clean Surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - a. SSPC-SP3, "Power Tool Cleaning."
 - 5. Priming: Apply primer in accordance with paint manufacturer's recommendations, and at a rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
- F. Finished Paint System:
- 1. Finished paint coats shall be in accordance with paint manufacturer's recommendations, and specification Division 9.
 - 2. Paint shall be free of sags, runs, drips or other defects. Allow ample drying time before handling to prevent damage to coatings.
 - 3. Strip paint corners, crevices, bolts, welds, and sharp edges.
 - 4. Apply one coat of shop paint to surfaces that will be inaccessible after assembly or erection.
- G. Galvanizing:
- 1. Hot-Dip Galvanized Finish: Apply Zinc coating by the hot-dip process to structural steel according to ASTM A 123.
 - a. Fill vent holes and grind smooth after galvanizing.
 - b. Unless otherwise noted on drawings or in Division 9, all exterior steel components exposed to the elements shall be galvanized, including, but not limited to, lintels.

2.3 LEED CREDIT

- A. LEED Credit MRc 4.1/4.2:
- 1. Steel products shall be made using an Electric Arc Furnace and shall have a minimum recycled content of 80%, including at least 65% post-consumer recycled content and 15% post-industrial recycled content.
 - 2. Steel products made using a Basic Oxygen Furnace shall have a minimum recycled content of 25%, including at least 20% post-consumer recycled content and 5% post-industrial recycled content.
- B. LEED Credit MRc 5.1/5.2:
- 1. Steel products shall be manufactured within 500 miles of project site. Recycled scrap products shall be procured from within 500 miles of the project site.

PART 3 - EXECUTION

3.1 ERECTION

A. Erection Procedures:

1. The erector and not the structural engineer of record shall be responsible for the means, methods and safety of erection of the structural steel framing.
2. Erection of all structural steel items shall meet the requirements of AISC "Specification and Code of Standard Practice."
3. All work shall be erected square, plumb, straight and true, accurately fitted and with tight joints and intersections, by mechanics experienced in the erection of structural steel. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
4. All base plates shall be supported on steel wedges, steel shims or heavy duty leveling nuts until the supported members have been leveled and plumbed.
 - a. Snug tighten anchor rods after supported members have been positioned and plumb. Do not remove wedges or shims but, if protruding, cut off flush with edge of base plate before packing with grout.
 - b. Promptly place non-shrink grout between bearing surfaces and base plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturers written installation instructions for shrinkage-resistant grouts.
5. Field connections of structural work shall be made with either high strength bolts (bearing type) or by welding. Proper precaution shall be taken to ensure that anchored items will not be distorted or overstressed due to improperly fabricated items.
6. Splice members only where indicated.
7. Do not use thermal cutting during erection unless approved by the Engineer/Architect in writing.
8. Steel erection shall not proceed without concrete in footings, piers, and walls attaining 75% of the intended minimum compressive design strength. Documentation must be provided indicating compliance with this requirement.

B. Bracing and Protection:

1. Steel shall be well plumbed, leveled and braced to prevent any movement.
 - a. Contractor shall provide and maintain all necessary temporary guying of steel frame to resist safely all wind and construction loads during erection and to assure proper alignment of all parts of the steel frame.
2. Provide all temporary flooring, bracing, shoring and guards necessary to prevent damage or injury. All partially erected steel shall be secured in an approved manner during interruptions of work.

C. Anchor and Foundation Rods:

1. All anchor or foundation rods and similar steel items to be built into concrete or masonry are to be set by the concrete or masonry contractors and shall be furnished promptly so that they may be built in as the work progresses because cutting of structural steel members to accommodate errors pertaining to embedded items will not be permitted.

3.2 FIELD WELDING

A. Welding Procedures:

1. All field welding shall be in accordance with AISC Specifications and conform to AWS D1.1 "Structural Welding Code - Steel".
 - a. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
 - b. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice" for Steel Buildings and Bridges" for mill material.
2. Contractor shall remove ceramic ferrules from shear connectors in sufficient time so as to allow for inspection of welds prior to placement of the concrete.

3.3 REPAIRS, PROTECTION, AND TOUCH UP

- A. Repair damaged galvanized coatings and on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Touch up Painting: After installation, promptly clean, prepare, and prime or reprime field welds, final connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates and abutting structural steel.
 1. Clean and prepare surfaces by SSPC-SP2 hand-tool cleaning or SSPC-SP3 power-tool cleaning.
 2. Apply a compatible primer of the same type as shop primer used on adjacent surfaces.

3.4 GROUTING

- A. Grouting under structural framing members shall be completed after all members have been plumbed and braced and before imposed loads are placed thereon.
- B. Remove all defective concrete, dirt, oil, grease and other foreign matter from surfaces to which grout will be placed.

3.5 MISCELLANEOUS STEEL AND STEEL LINTELS

- A. Furnish and install all miscellaneous steel as detailed in Architectural and Structural Drawings.
- B. The steel fabricator shall furnish all steel lintels required for masonry wall construction indicated in the Architectural and Structural Drawings and Schedules.

- C. Provide additional steel framing for continuous support of steel deck edges at openings and column interruptions.
- D. All exterior exposed steel shall be hot-dip galvanized in accordance with ASTM A123 painted in accordance with Division 9 after fabrication.

END OF SECTION 05 12 23

SECTION 05 21 00 - STEEL JOISTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The General and Supplementary Conditions of the Construction Contract and Division 1 - General Requirements apply to the work specified in this section.
- B. This section includes the fabrication and erection of open web steel joists. Work shall include but not be limited to, the following items:
 - 1. K-series and LH-series
 - 2. Joist substitutes.
 - 3. Bridging.
 - 4. Joist anchors and connections.
- C. Perform work in accordance with SJI Standard Specifications, Load Tables, and Weight Tables for Steel Joist and Joist Girders.
- D. Structural notes indicated on drawings regarding steel joists shall be considered a part of this specification.

1.2 QUALITY ASSURANCE

- A. Codes and Standards: Comply with the provisions of the following codes, specifications and standards, except where more stringent requirements are shown or specified.
 - 1. AISC 360-05 – Specification for Structural Steel Buildings – Allowable Strength Design, 13th Edition.
 - 2. ASTM A108 - Standard Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality.
 - 3. ASTM A153 - Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.
 - 4. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
 - 5. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - 6. ASTM A36 – Standard Specification for Carbon Structural Steel
 - 7. ASTM A572 - Standard Specification for High Strength, Low-Alloy Columbium-Vanadium Structural Steel
 - 8. AWS D1.1 - Structural Welding Code.
 - 9. SJI – Standard Specification for Open Web Steel Joists, K-Series
 - 10. SJI - Standard Specifications for Longspan Steel Joists LH-Series and Deep Longspan Steel Joists DLH-Series.
 - 11. SSPC - Steel Structures Painting Council.

- B. Where any provisions of other pertinent codes and standards conflict with this specification, the more stringent provision shall govern.

1.3 TESTING AND INSPECTION

A. Special Inspection and Testing:

1. In accordance with Chapter 17 of the International Building Code, the Owner shall employ a Special Inspection Agency to perform the duties and responsibilities specified in Section 1704.0 of the International Building Code.
2. The Owner Contractor shall employ an Inspection Agency to perform the duties and responsibilities specified below.
3. Refer to architectural, civil, mechanical, and electrical specifications for testing and inspection requirements of non-structural components.
4. Work performed on the premises of a fabricator approved by the building official need not be tested and inspected per the table below. The fabricator shall submit a certificate of compliance that the work has been performed in accordance with the approved plans and specification to the building official and the Architect and Engineer of Record.
5. Duties of the Special Inspection Agency:
 - a. Perform all testing and inspection required per approved testing and inspection program.
 - b. Furnish inspection reports to the building official, the Owner, the Architect, the Engineer of Record, and the General Contractor. The reports shall be completed and furnished within 48 hours of inspected work.
 - c. Submit a final signed report stating whether the work requiring special inspection was, to the best of the Special Inspection Agency's knowledge in conformance with the approved plans and specifications.
6. Structural Component Testing and Inspection Schedule for Section 05 21 00 is as follows:

	Continuous	Periodic	Referenced Standard	IBC Reference
Structural Steel Joists				
Material verification of structural steel				1708.4
Identification markings to conform to ASTM standards specified in the approved construction documents		X	ASTM A6 or ASTM A568	
Material verification of weld filler materials:			AISC ASD Section A3.6, AISC LRFD Section A3.5	
Manufacturer's certificate of compliance required		X		
Inspection of welding:			AWS D1.1	1704.3.1

	Continuous	Periodic	Referenced Standard	IBC Reference
Structural Steel Joists				
A. Single-pass fillet welds $\leq 5/16"$ (7.9 mm)		X		
Inspection of steel frame joint details for compliance with approved construction documents				1704.3.2
A. Details such as bracing and stiffening	X			
B. Member locations	X			
C. Application of joint details at each connection	X			

1.4 SUBMITTALS

- A. Prepare and submit shop and erection drawings for Engineer's approval.
- B. Shop Drawings:
 - 1. Indicate standard designations, configuration, sizes, spacing, location of joists, joist chord extensions.
 - 2. Joining and anchorage details of attachment to other construction.
 - 3. Size, location and configuration of all code required bridging, bracing and connections.
 - 4. Joist cambers.
 - 5. Type of paint and shop primer.
- C. Welder's Certificates: Submit certification for all welders employed on the project demonstrating they have been AWS qualified to perform the welding procedures required for this project.
- D. LEED Certification: Submit manufacturer's certification for each steel product including the following:
 - 1. LEED Credit MRc 4.1/4.2 – Recycled content, including percentage of pre-consumer (post-industrial) and post-consumer recycled content. Also provide manufacturer's name, product cost and steel processing furnace type.
 - 2. LEED Credit MRc 5.1/5.2 – Location of manufacturing plant, manufacturer's name, product cost and location of extraction or harvest of raw materials.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in performing the work of this section with minimum ten (10) years documented experience. Fabrication Company shall be certified by the Steel Joist Institute (SJI) to manufacture joists complying with the SJI Standard Specifications and Load Tables.
- B. Manufacturer shall assume responsibility for engineering special joists indicated on the Drawings to comply with the SJI standard specification performance requirements. This responsibility includes the preparation of Shop Drawings and comprehensive engineering

analysis by a qualified structural engineer licensed in the state where the project is located.

- C. Erector: Company specializing in performing the work of this section with minimum five (5) years documented experience.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. All joists and accessories shall be transported, stored and erected in a manner, which will prevent any damage or deformation. Damaged joists shall not be erected or repaired without Structural Engineer's approval. Joists shall be stored clear of the ground in such a manner so as to eliminate excessive handling, and protect from weather with a weatherproof covering.
- B. Deliver and store all joists and accessories to the site according to all SJI requirements.

1.7 FIELD MEASUREMENTS

- A. Verify that field measurements are as shown on the drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Bar Joists: Steel used in the manufacture of bar joists shall be as allowed by the Steel Joist Institute (SJI) standard specification for chord and web members.
- B. High Strength Bolts and Nuts: ASTM A325, Type 1 heavy hex steel structural bolts, heavy hex carbon steel nuts, and hardened carbon steel washers. Finish shall be plain, uncoated.
- C. Carbon Steel Bolts and Threaded Fasteners: ASTM A307, Grade A, carbon steel, hex head bolts and threaded fasteners; carbon steel nuts; and flat unhardened steel washers. Finish shall be plain, uncoated mechanically deposited zinc coating, ASTM B695, Class 50.
- D. Miscellaneous items, such as bridging, headers, bolts, nuts, washers, anchors and all other appurtenances for a complete metal joist installation shall be furnished as a part of the work of this section.
- E. Primer: Provide the manufacturer's standard shop primer with good resistance to normal atmospheric corrosion and complying with the performance requirements specified in the SJI "Standard Specification" previously cited.
 - 1. Do not prime paint joists and accessories scheduled to receive spray applied fireproofing.
 - 2. Contractor shall certify compatibility of shop primer coat with field applied paint finishes or fireproofing required for this project.
- F. Welding Materials: AWS D1.1; type required for materials being welded.

2.2 FABRICATION AND MANUFACTURE

- A. Manufacture K-Series steel joists according to "Standard Specification for Open Web Steel Joists, K-Series," in SJI "Specifications," with steel angle top and bottom chord members, underslung ends, and parallel top chords; of joist type indicated.
- B. Manufacture long span steel joists according to "Standard Specifications for Longspan Steel Joists, LH-Series and Deep Longspan Steel Joists, DLH-Series," in SJI's "Specifications," with steel-angle top- and bottom-chord members; of joist type and end and top-chord arrangements as indicated on the Drawings.
- C. All steel joists shall consist of an electrically welded open-web type, designed and fabricated to conform to the "Standard Specifications" included in the SJI or AISC publications cited above and shall be manufactured by a current member of the Steel Joist Institute.
- D. Provide holes in chord members for connecting and securing other construction to joists. General Contractor shall coordinate this information and provide the manufacturer with drawings outlining the location of any required holes.
- E. Bridging members for open web joists, unless otherwise indicated on the drawings, shall be continuous wall to wall, complete with suitable anchorage at each end, all in accordance with SJI "Standard Specifications".
- F. Design and fabricate joists and bridging to support a minimum net uplift as indicated on the drawings of 10 psf. A 1/3 stress increase shall not be used in uplift design.
- G. Camber joists in accordance with SJI Standard Specification.
- H. All steel joists including all accessories, before leaving the shop shall be thoroughly cleaned of all mill scale, rust and foreign matter and shall be given one (1) coat of primer complying with the performance requirements specified in the SJI "Standard Specification" previously cited.
- I. Provide bottom and top chord extensions as indicated on the Drawings. Top chord extensions shall be SJI's Type S.
- J. Provide extended bearing ends of joists with SJI's Type R extended ends where indicated on the Drawings.

2.3 CLEANING, PRIMING AND PAINTING

- A. Clean joist by using solvent cleaning, SSPC-SP 1 to remove oil and grease.
- B. Apply one shop coat of primer to joists and joist accessories to be primed to provide a continuous dry film thickness of not less than 1 mil.
- C. Painting of joists and joist accessories is specified in Division 9 Section "Painting."

2.4 LEED CREDIT

- A. LEED Credit MRc 4.1/4.2:
 - 1. Steel products shall be made using an Electric Arc Furnace and shall have a minimum recycled content of 80%, including at least 65% post-consumer recycled content and 15% post-industrial recycled content.

2. Steel products made using a Basic Oxygen Furnace shall have a minimum recycled content of 25%, including at least 20% post-consumer recycled content and 5% post-industrial recycled content.
- B. LEED Credit MRc 5.1/5.2:
1. Steel products shall be manufactured within 500 miles of project site. Recycled scrap products shall be procured from within 500 miles of the project site.

PART 3 - EXECUTION

3.1 ERECTION

- A. Erection of all metal joist items shall meet the applicable requirements of the SJI "Standard Specifications" previously cited.
- B. All anchor bolts, wall anchors, bridging anchors, bearing plates and similar items to be built into concrete or masonry are to be set by the concrete or masonry contractors and shall be furnished promptly so that they may be built-in as the work progresses as no cutting for the same afterward will be permitted. Beginning of installation means erector accepts existing conditions.
- C. All metal joists shall be accurately set to the lines, elevations and dimensions indicated on the approved shop drawings.
- D. Bridging shall be installed concurrently with joist erection and before loads are applied. Bridging shall be securely welded to joist chords in a manner that will not damage joist members and so as to insure positive resistance to both tensile and compressive stresses. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.
- E. All K-series joists must bear a minimum of 4 inches on masonry or concrete surfaces and a minimum of 2-1/2 inches on steel surfaces. All LH-series and DLH-series joists shall bear a minimum of 6 inches on masonry or concrete surfaces and a minimum of 4 inches on steel surfaces. All joists bearing on concrete or masonry shall bear on a steel bearing plate and joists bearing on steel shall be welded to the supporting steel.
- F. K-series joists shall be anchored at a minimum with (2) 1/8" fillet welds (1" long) at each support, or (2) 1/2" diameter bolts. LH-series and DLH-series joists shall be anchored at a minimum with (2) 1/4" fillet welds (2" long) at each support, or (2) 3/4" diameter bolts.
- G. All field welding shall be in accordance with AWS previously cited.
- H. All construction loads shall be kept off joists until they are permanently anchored and bridged. During construction, care shall be taken to avoid excessive concentrated or moving loads. Provide for adequate distribution of any such loads so that the carrying capacity of the joists is not exceeded.
- I. Joist shall not be positioned any greater than 1/4 inch from true alignment, and shall not vary more than 1/4 inch from plumb.

3.2 FIELD TOUCH UP

- A. Immediately after erection, Contractor shall touch up all erection bolts, all field welds and all scratched or abraded areas and paint out erection markings with matching rust-inhibitive primer in color and formulation to match shop primer.

END OF SECTION 05 21 00

SECTION 05 31 00 - STEEL DECK

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The General and Supplementary Conditions of the Construction Contract and Division 1 - General Requirements apply to the work specified in this section.
- B. This section includes the fabrication and erection of steel deck. The Work shall include, but not be limited to the following:
 - 1. Roof deck, roof deck accessories, and roof deck fasteners.
 - 2. Acoustical roof deck, acoustical insulation component and accessories.
 - 3. Composite floor deck.
- C. Structural notes indicated on the drawings regarding steel decking shall be considered a part of this specification.

1.2 QUALITY ASSURANCE

- A. Codes and Standards: Comply with the provisions of the following codes, specifications and standards, except where more stringent requirements are shown or specified.
 - 1. AISI - Specification for the Design of Cold-Formed Steel Structural Members.
 - 2. ANSI/AWS D1.1 - Structural Welding Code.
 - 3. ANSI/AWS D1.3 - Structural Welding Code - Sheet Steel.
 - 4. ASTM A1008- Standard Specification for Structural Steel (SS), Sheet, Carbon, Cold-Rolled
 - 5. ASTM A36 – Standard Specification for Carbon Structural Steel.
 - 6. ASTM A653 - Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process.
 - 7. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
 - 8. SDI - Design Manual for Composite Decks, Form Decks, Roof Decks by the Steel Deck Institute.
- B. Manufacture steel decking in accordance with the Steel Deck Institute's (SDI) "Design Manual for Composite Decks, Form Decks and Roof Decks".
- C. All steel deck shall be designed and fabricated in accordance with the above AISI and SDI specifications. The gauges and section moduli indicated on the drawings or specified herein are minimum and the gauge and section modules of the deck furnished shall meet or exceed these minimum requirements. All gauges are United States standard, measured prior to coating.
- D. Contractor to verify that the manufacturer's steel deck type selected is listed on the UL fire rated roof assembly specified by the Architect for this project.

- E. Where any provisions of other pertinent codes and standards conflict with this specification, the more stringent provision shall govern.
- F. Contractor to have pre-installation meeting where installer demonstrates workmanship by conducting representative fastenings at pre-installation meeting, subject to guidance from mechanical fastener manufacturer representative.

1.3 TESTING AND INSPECTION

A. Special Inspection and Testing:

1. In accordance with Chapter 17 of the International Building Code, the Owner shall employ a Special Inspection Agency to perform the duties and responsibilities specified in Section 1704.0 of the International Building Code.
2. Refer to architectural, civil, mechanical, and electrical specifications for testing and inspection requirements of non-structural components.
3. Work performed on the premises of a fabricator approved by the building official need not be tested and inspected per the table below. The fabricator shall submit a certificate of compliance that the work has been performed in accordance with the approved plans and specification to the building official and the Architect and Engineer of Record.
4. Duties of the Special Inspection Agency:
 - a. Perform all testing and inspection required per approved testing and inspection program.
 - b. Furnish inspection reports to the building official, the Owner, the Architect, the Engineer of Record, and the General Contractor. The reports shall be completed and furnished within 48 hours of inspected work.
 - c. Submit a final signed report stating whether the work requiring special inspection was, to the best of the Special Inspection Agency's knowledge in conformance with the approved plans and specifications.
5. Structural Component Testing and Inspection Schedule for Section 05 31 00 is as follows:

	Continuous	Periodic	Referenced Standard	IBC Reference
Steel Deck				
Material verification of structural steel				1708.4
Identification markings to conform to ASTM standards specified in the approved construction documents		X	ASTM A6 or ASTM A568	
Manufacturer's certified mill test reports required		X	ASTM A6 or ASTM A568	
Material verification of weld filler materials:			AISC ASD Section A3.6, AISC LRFD Section A3.5	
Manufacturer's certificate of compliance required		X		
Inspection of welding:			AWS D1.1	1704.3.1

Steel Deck	Continuous	Periodic	Referenced Standard	IBC Reference
A. Floor and deck welds		X	AWS D1.3	

1.4 QUALIFICATIONS

- A. Fabricator: Company specializing in performing the work of this section with minimum five (5) years documented experience at manufacturing steel deck. Fabrication Company shall be a current member of the Steel Deck Institute (SDI).
- B. Erector: Company specializing in performing the work of this section with minimum five (5) years documented experience at erecting steel deck.

1.5 SUBMITTALS

- A. Prepare and submit shop drawings for Engineer’s approval. Shop drawings shall indicate deck layout, depth, uncoated metal thickness, framing and supports with unit dimensions and sections and complete end jointing.
- B. Provide details of all accessories.
- C. Shop drawings shall also indicate typical welding or mechanical anchoring pattern for steel deck and accessories.
- D. Prepare and submit allowable construction span tables and allowable total load tables for Engineer’s approval. Tables shall be accompanied with a letter of certification from the manufacturer stating the tabulated design values were determined in accordance with the steel deck institute’s “Design Manual for Composite Decks, Form Decks, and Roof Decks.”
- E. Provide manufacturer’s latest recommendations and installation instructions.
- F. Prepare and submit product data of proposed materials.
- G. Submit samples, when requested, of proposed materials for Engineer’s approval.
- H. LEED Certification: Submit manufacturer’s certification for each steel product including the following:
 - 1. LEED Credit MRc 4.1/4.2 – Recycled content, including percentage of pre-consumer (post-industrial) and post-consumer recycled content. Also provide manufacturer’s name, product cost and steel processing furnace type.
 - 2. LEED Credit MRc 5.1/5.2 – Location of manufacturing plant, manufacturer’s name, product cost and location of extraction or harvest of raw materials.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. All decking materials shall be transported, stored and erected in a manner that will prevent damage or deformation of sheets. Damaged material shall not be erected or repaired without Structural Engineer’s approval.

- B. Deck panels shall be stored clear of the ground, elevated on one end, and protected from weather with waterproof covering.

1.7 COORDINATION

- A. Coordinate the installation of the sound-absorbing insulation strips in the topside ribs of the acoustical deck with roof installation specified in Division 7 to ensure protection of insulation strips against damage from the effects of weather and other elements.
- B. Portions of decking to receive spray applied fireproofing shall be galvanized finish. Contractor shall certify compatibility of any shop primer with field applied finishes or fireproofing required for this project.

PART 2 - PRODUCTS

2.1 STEEL ROOF DECK

- A. Standard Steel Roof Deck: Fabricate panels to comply with "SDI Specification and Commentary for Steel Roof Deck," and the following:
 - 1. Steel decking sheet material, minimum yield strength, depth, gage, profile, and finish are indicated on the Drawings, as classified by Steel Deck Institute (SDI). Panels shall be formed with integral ribs and overlapping side flanges.
 - 2. Galvanized Steel Sheet: ASTM A653 Structural Steel (SS), Grade 33, with a G60 zinc coating conforming to ASTM A924 for galvanized deck.

2.2 ACOUSTICAL STEEL ROOF DECK

- A. Acoustical Steel Roof Deck: Fabricate panels to comply with "SDI Specification and Commentary for Steel Roof Deck," and the following:
 - 1. Steel decking sheet material, minimum yield strength, depth, gage, profile, and finish are indicated on the Drawings, as classified by Steel Deck Institute (SDI). Panels shall be formed with integral ribs and overlapping side flanges.
 - 2. Acoustical Perforations: Deck units with manufacturer's standard perforated vertical webs.
 - 3. Sound Absorbing Insulation: Provide the deck manufacturer's standard premolded roll or strip glass fiber or mineral fiber insulation. Provide continuous wire mesh deck/insulation spacers for field painted decking.
 - 4. Acoustical Performance: NRC = 0.95
 - 5. Galvanized Steel Sheet: ASTM A653 Structural Steel (SS), Grade 33, with a G60 zinc coating conforming to ASTM A924 for galvanized deck.

2.3 COMPOSITE FLOOR DECK

- A. Composite Floor Deck: Fabricate panels with integrally embossed or raised pattern ribs to comply with "SDI Specification and Commentary for Composite Steel Floor Deck," and the following:

1. Steel decking sheet material, minimum yield strength, depth, gage, profile, and finish are indicated on the Drawings, as classified by Steel Deck Institute (SDI). Panels shall be formed with integral ribs and overlapping side flanges.
2. Galvanized Steel Sheet: ASTM A653 Structural Steel (SS), Grade 33, with a G60 zinc coating conforming to ASTM A924 for galvanized deck.

2.4 FASTENERS

A. Support Fasteners:

1. Welded: 5/8" diameter electric arc spot (puddle) welds. Refer to Drawings for weld spacing requirements.
 - a. Weld washers required for material less than 0.028" thick. Welding washers shall have a minimum thickness of 0.0598 inches and be applicable to AWS D1.3 type welding and of type as recommended by the deck manufacturer.
 - b. Weld metal shall penetrate all layers of deck material and shall have good fusion to the supporting steel. Fasten ribbed deck to steel support members at ends and intermediate supports.
 - 1) All welding shall be in conformance with previously cited AWS recommendations in appearance and quality of welds, and the methods used in correcting welding work.
2. Screws: Zinc-coated, self-drilling, self-tapping screws (minimum No. 12) steel screws. Refer to Drawings for fastener spacing requirements.

B. Side Lap Fasteners:

1. Mechanical: Zinc coated self-drilling, self-tapping type (minimum No. 10) steel screws. Refer to Drawings for fastener spacing requirements.

2.5 ACCESSORIES

- A. Provide all closers, fillers, starters, sump pans, metal cant strips, , pour stops, column closures, girder fillers, and similar accessories required for a complete installation. Provide cover plates at all locations where direction of deck span changes. Unless otherwise noted, accessories shall be of the same steel sheet material, finish, and thickness as the deck sections.
- B. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- C. Recessed Sump Pans: Single piece steel sheet of same material, finish and thickness as the deck, with 3 inch wide flanges and recessed pan of 1-1/2 inch minimum depth. Cut drain holes in the field.

2.6 LEED CREDIT

A. LEED Credit MRc 4.1/4.2:

1. Steel products shall be made using an Electric Arc Furnace and shall have a minimum recycled content of 80%, including at least 65% post-consumer recycled content and 15% post-industrial recycled content.

2. Steel products made using a Basic Oxygen Furnace shall have a minimum recycled content of 25%, including at least 20% post-consumer recycled content and 5% post-industrial recycled content.
- B. LEED Credit MRc 5.1/5.2:
1. Steel products shall be manufactured within 500 miles of project site. Recycled scrap products shall be procured from within 500 miles of the project site.

PART 3 - EXECUTION

3.1 ERECTION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Deck units and deck accessories herein specified shall be thoroughly and securely erected by experienced workmen fastening to supporting steel members as herein specified. All work shall be in conformance with manufacturer's latest printed recommendations and approved shop drawings.
- C. Beginning of installation means installer accepts existing conditions.
- D. The finished work shall be true, flat planes and to slopes indicated with end joints flush and without sharp protruding edges. Exposed underside of deck shall be true without defect.
- E. Erector shall cut all openings in deck for piping and equipment furnished by other trades. Wherever ribs are cut and are not supported by supplemental framing, the erector shall provide steel angles of adequate size on all sides of the opening welded to the underside of each rib.
- F. Burning of holes in decking will not be permitted.
- G. Steel decking shall be installed to span supporting steel members at right angles. Panels shall be securely anchored to each structural support it rests on or passes.

3.2 ROOF DECK

- A. Fasten roof deck panels to steel supporting members using welds and mechanical fasteners, as specified herein and on the Drawings.
- B. Unless noted otherwise, secure side laps and perimeter edges of units with fasteners at mid-span between supports or 36 inches on center, whichever distance is smaller.
- C. Deck shall be fastened through the bottom of the deck rib to all structural supports for the specific deck sections.
- D. End bearing of roof decking shall have a minimum of 1-1/2 inches of bearing occurring over structural supports
- E. End joints shall be lapped 2 inches minimum.
- F. Install sound absorbing insulation into the topside ribs of the acoustical deck as specified in the deck manufacturer's installation instructions. Coordinate with the roofing installation to protect the insulation from damage.

- G. Place deck panels on structural supports and adjust to final position with ends aligned. Attach to supports immediately after placement.
- H. Roof sump pans shall be installed over openings provided in roof deck with flanges welded to the top of the deck. Space welds at 12 inches apart with at least 1 weld in each corner.
- I. Install all roof deck accessories in accordance with the roof deck manufacturer's written instructions.

3.3 FLOOR DECK

- A. Fasten steel floor deck to supporting steel with 5/8" diameter electric arc spot (puddle) welds spaced at 12" O.C. minimum. Secure side laps and perimeter edges of units with fasteners at mid-span between supports or 36 inches on center, whichever distance is smaller.
- B. Place deck panels on structural supports and adjust to final position with ends aligned. Attach to supports immediately after placement.
- C. Install deck ends over supports with a minimum end bearing of 1-1/2 inches.
- D. Install pour stops and girder fillers to supporting structure according to manufacturer's recommendations.
- E. Fasten column closures and cell closures to deck to provide a tight fit. Provide cell closures at changes of direction of deck units, unless otherwise noted.
- F. Install all floor deck accessories in accordance with the floor deck manufacturer's written instructions.
- G. If steel studs shear connectors are being applied through the deck onto the structural steel for composite floor construction, the stud welds can be used to replace the specified puddle welds.
- H. Composite deck sheets with shear stud connectors shall be butted over supporting members. Standard tolerance for ordered lengths is plus or minus 1/2 inch.

3.4 FIELD TOUCH UP

- A. After erection, all weld burn marks and abraded spots shall be cleaned and field painted with a rust-inhibiting metal primer matching formulations and color of shop coat or a zinc-rich rust inhibiting paint for galvanized deck surfaces.

END OF SECTION 05 31 00

SECTION 05 40 00 - 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. Exterior non-load-bearing wall framing.
3. Floor joist framing.
4. Soffit framing.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for masonry shelf angles and connections.
2. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies.
3. Section 09 22 16 "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.

B. LEED Submittals:

1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

C. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

- D. Delegated-Design Submittal: For cold-formed steel framing.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency.
 - 1. Steel sheet.
 - 2. Expansion anchors.
 - 3. Power-actuated anchors.
 - 4. Mechanical fasteners.
 - 5. Vertical deflection clips.
 - 6. Horizontal drift deflection clips
 - 7. Miscellaneous structural clips and accessories.
- C. Research Reports: For non-standard cold-formed steel framing, from ICC-ES.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. 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."

1.6 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.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design cold-formed steel framing.
- B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated.
 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Interior Load-Bearing Wall Framing: Horizontal deflection of $1/360$ of the wall height under a horizontal load of 5 lbf/sq. ft..
 - b. Exterior Non-Load-Bearing Framing: Horizontal deflection of $1/360$ of the wall height.
 - c. Floor Joist Framing: Vertical deflection of $1/360$ for live loads and $1/240$ for total loads of the span.
 3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
 4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of $3/4$ inch.
 5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
- C. Cold-Formed Steel Framing Design Standards:
1. Floor and Roof Systems: AISI S210.
 2. Wall Studs: AISI S211.
 3. Headers: AISI S212.
 4. Lateral Design: AISI S213.
- D. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.
- E. 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. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 1. Grade: As required by structural performance.
 2. Coating: G60, A60, AZ50, or GF30 for interior framing; G90 or equivalent for framing in exterior walls and soffits.

- C. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
 - 1. Grade: As required by structural performance.
 - 2. Coating: G90.

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.
 - 2. Flange Width: minimum 1-3/8 inches.
- 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.
- 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.
 - 2. Flange Width: Minimum 1-3/8 inches.

2.5 EXTERIOR NON-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: 0.0538 inch.
 - 2. Flange Width: 1-5/8 inches.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0538 inch.
 - 2. Flange Width: 1-1/4 inches.
- C. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0538 inch .

2. Flange Width: 1 inch plus the design gap for one-story structures and 1 inch plus twice the design gap for other applications.
- E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.6 FLOOR JOIST FRAMING

- A. Steel Joists: Manufacturer's standard C-shaped steel joists, of web depths indicated, unpunched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0428 inch .
 2. Flange Width: 1-5/8 inches, 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: Matching steel joists.
 2. Flange Width: 1-1/4 inches, minimum.

2.7 SOFFIT FRAMING

- A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0538 inch.
 2. Flange Width: 1-5/8 inches, minimum.

2.8 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. Web stiffeners.
 4. Anchor clips.
 5. End clips.
 6. Foundation clips.
 7. Gusset plates.
 8. Stud kickers and knee braces.
 9. Joist hangers and end closures.
 10. Hole reinforcing plates.
 11. Backer plates.

2.9 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. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.
- D. 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.
- E. 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.
- F. Welding Electrodes: Comply with AWS standards.

2.10 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A 780.
- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30-minute working time.
- D. 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.
- E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.11 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 and as follows:
1. Spacing: Space individual framing members no more than plus or minus 1/8 inch 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.

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. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.
- C. 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 to ensure a uniform bearing surface on supporting concrete or masonry construction.

- D. 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.
- 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. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 07 21 00 "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.
- J. 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 and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch 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: 24 inches.
- B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch 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.
- 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 as indicated on Shop Drawings. 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 deep.
2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 3. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- J. 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 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to bottom track unless otherwise indicated. Space studs as follows:
 1. Stud Spacing: 16 inches.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 1. Install single deep-leg deflection tracks and anchor to building structure.
 2. Connect vertical deflection clips to bypassing studs and anchor to building structure.
 3. Connect drift clips to cold-formed metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
 1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
 - a. Install solid blocking at centers indicated on Shop Drawings.
 2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 JOIST INSTALLATION

- A. 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.
 - 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.
- B. Space joists not more than 2 inches from abutting walls, and as follows:
 - 1. Joist Spacing: 16 inches.
- C. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:
 - 1. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.
- D. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.
- E. 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.

3.7 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 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.

3.9 TESTING AND INSPECTION

- A. Duties of the Testing and Inspection Agency:
1. Perform all testing and inspection required per approved testing and inspection program.
 2. Furnish inspection reports to the Building Official, the Owner, the Architect, the Engineer of Record, and the General Contractor. The reports shall be completed and furnished within 48 hours of inspection work.
 3. Submit a final signed report stating whether the work was, to the best of the Testing and Inspection Agency's knowledge, in conformance with the approved plans and specifications.
- B. Testing and Inspection Schedule:
1. Material verification of structural steel, per IBC 1708.4.
 - a. Identification markings to conform to ASTM standards specified in the approved construction documents: Periodic inspection, per ASTM A6 or ASTM A568.
 - b. Manufacturer's certified mil test reports: Periodic inspection, per ASTM A6 or ASTM A568.
 2. Material verification of weld filler materials, per AISC 360, section A3.5.
 - a. Identification markings to conform to ASTM standards specified in the approved construction documents: Periodic inspection.
 - b. Manufacturer's certificate of compliance required: Periodic inspection.
 3. Inspection of welding:
 - a. Welding of cold-formed structural steel framing: Periodic inspection, per AWS D1.3.
 4. Inspection of steel frame joint details for compliance with approved construction documents, per IBC 1704.3.2:
 - a. Details such as bracing and stiffening: Periodic inspection.
 - b. Member locations: Periodic inspection.
 - c. Application of joint details at each connection: Periodic inspection.

END OF SECTION 05 40 00

SECTION 05 50 00 - 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 framing and supports for ceiling-hung toilet compartments.
 - 2. Steel framing and supports for operable partitions.
 - 3. Steel framing and supports for overhead doors.
 - 4. Steel framing and supports for mechanical and electrical equipment.
 - 5. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - 6. Elevator machine beams.
 - 7. Steel shapes for supporting elevator door sills.
 - 8. Metal ladders.
 - 9. Metal bollards.
 - 10. Loose bearing and leveling plates for applications where they are not specified in other Sections.
- B. Products furnished, but not installed, under this Section:
 - 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.
 - 3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.
- C. Related Sections:
 - 1. Section 04 20 00 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
 - 2. Section 05 12 00 "Structural Steel Framing."
 - 3. Section 05 51 00 "Metal Stairs."
 - 4. Section 05 73 00 "Decorative Metal Railings."

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design ladders , including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling,

opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Paint products.
3. Grout.

B. LEED Submittals:

1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

C. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1.5 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."

1.6 PROJECT CONDITIONS

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

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 and steel weld plates and angles for casting into concrete. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- 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.

2.2 FERROUS METALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.
- D. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 - 1. Size of Channels: 1-5/8 by 1-5/8 inches.
 - 2. Material: Galvanized steel, ASTM A 653/A 653M, commercial steel, Type B, with G90 coating; minimum 0.079-inch nominal thickness.

2.3 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, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3; with hex nuts, ASTM A 563, Grade C3; and, where indicated, flat washers.
- D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.
- E. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; 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. Eyebolts: ASTM A 489.

- G. Machine Screws: ASME B18.6.3.
- H. Lag Screws: ASME B18.2.1.
- I. Wood Screws: Flat head, ASME B18.6.1.
- J. Plain Washers: Round, ASME B18.22.1.
- K. Lock Washers: Helical, spring type, ASME B18.21.1.
- L. 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, conducted by a qualified independent testing agency.
- M. 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.
- N. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.
- O. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches 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.

2.4 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. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- F. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.

- G. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- H. Concrete: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

2.5 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 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 will be 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.
 - 1. 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, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 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. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as recommended by partition manufacturer. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.
- D. Galvanize miscellaneous framing and supports where indicated.

2.7 METAL LADDERS

- A. General:
 - 1. Comply with ANSI A14.3 unless otherwise indicated.
 - 2. For elevator pit ladders, comply with ASME A17.1.
- B. Steel Ladders:
 - 1. Space siderails 16 inches apart unless otherwise indicated.
 - 2. Space siderails of elevator pit ladders 12 inches apart.
 - 3. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges.
 - 4. Rungs: 3/4-inch- diameter steel bars.
 - 5. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
 - 6. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
 - 7. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
 - 8. Galvanize ladders, including brackets and fasteners.

2.8 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 40 steel pipe .
 - 1. Cap bollards with 1/4-inch- thick steel plate.
 - 2. Where bollards are indicated to receive controls for door operators, provide necessary cutouts for controls and holes for wire.
- B. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch- thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and 3/4 inch

larger than OD of bollard.

- C. Prime bollards with zinc-rich primer.

2.9 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.
- C. Prime plates with zinc-rich primer.

2.10 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. Galvanize loose steel lintels located in exterior walls.

2.11 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.

2.12 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.
- C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.13 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. 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.

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 will 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.

- B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

3.3 INSTALLING METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
- B. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete in formed or core-drilled holes not less than 8 inches deep and 3/4 inch larger than OD of bollard. Fill annular space around bollard solidly with nonshrink, nonmetallic grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.

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 grout.
 - 1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations unless otherwise indicated.
 - 2. 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 dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05 50 00

SECTION 05 51 00 - 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.
2. Industrial-type stairs with steel floor plate and grating treads.
3. Steel tube railings attached to metal stairs.
4. Steel tube handrails attached to walls adjacent to metal stairs.

B. Related Sections:

1. Section 03 30 00 "Cast-in-Place Concrete" for concrete fill for stair treads and platforms.
2. Section 05 73 00 "Decorative Metal Railings" for ornamental metal railings.
3. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood blocking 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..
2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
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/360 or 1/4 inch, whichever is less.

- C. Structural Performance of Railings: Railings 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. applied in any direction.
- b. Concentrated load of 200 lbf applied in any direction.

- c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
 - b. Infill load and other loads need not be assumed to act concurrently.
- D. Seismic Performance: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. Component Importance Factor is 1.5.

1.4 ACTION SUBMITTALS

- A. Product Data: For metal stairs and the following:
 - 1. Prefilled metal-pan stair treads.
 - 2. Paint products.
 - 3. Grout.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1.5 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.
 - a. For use at interior egress stairs.
 - 2. Industrial-Type Stairs: Industrial class.
 - a. For use at exterior maintenance-access stairs; provide with steel grating treads.
 - b. For use at interior stairs within mechanical and electrical spaces; provide with abrasive steel floor plate.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

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

1.6 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. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513.
- D. Abrasive-Surface Floor Plate: Steel plate with abrasive granules rolled into surface or with abrasive material metallurgically bonded to steel.
- E. Steel Bars for Grating Treads: ASTM A 36/A 36M or steel strip, ASTM A 1011/A 1011M or ASTM A 1018/A 1018M.
- F. Wire Rod for Grating Crossbars: ASTM A 510.
- G. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, either commercial steel, Type B, or structural steel, Grade 30, unless another grade is required by design loads.
- H. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 coating, either commercial steel, Type B, or structural steel, Grade 33, unless another grade is required by design loads.

2.3 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, 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.

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. For use at interior stairs.
 - 2. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
 - 1. For use at exterior stairs and stairs within mechanical and electrical spaces.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- G. Concrete Materials and Properties: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.

2.5 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts,[railings,] 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.
 - 3. Fabricate treads and platforms of exterior stairs so finished walking surfaces slope to drain.
- 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 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 1 welds: no evidence of a welded joint at preassembled stairs, and Type 4 welds: good quality, uniform undressed weld with minimal splatter at industrial stairs.
- 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 or tubes.
 - a. Provide closures for exposed ends of stringers.
 - 2. Construct platforms of steel plate or channel headers and miscellaneous framing members as needed to comply with performance requirements.
 - 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 shaft-wall 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, subtread 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. Steel Sheet: Uncoated hot-rolled steel sheet unless otherwise indicated.
 2. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
 3. Shape metal pans to include nosing integral with riser.
 4. At Contractor's option, provide stair assemblies with metal-pan subtreads 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.
- C. Abrasive-Coating-Finished, Formed-Metal Stairs: Form risers, treads, and platforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.097 inch.
1. Steel Sheet: Uncoated hot-rolled steel sheet unless otherwise indicated.
 2. Directly weld risers and treads to stringers; locate welds on underside of stairs.
 3. Provide platforms of configuration indicated or, if not indicated, the same as treads. Weld platforms to platform framing.
 4. Finish tread and platform surfaces with manufacturer's standard epoxy-bonded abrasive finish.
- D. Metal Bar-Grating Stairs: Form treads and platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manual."
1. Fabricate treads and platforms from [welded] [or] [pressure-locked] steel grating with [1-1/4-by-3/16-inch bearing bars at 15/16 inch o.c.] [1-by-3/16-inch bearing bars at 11/16 inch o.c.] [1-by-1/8-inch bearing bars at 7/16 inch o.c.] and crossbars at 4 inches o.c.
 2. Fabricate treads and platforms from welded or pressure-locked steel grating with openings in gratings no more than 1/2 inch in least dimension.
 3. Surface: Serrated.
 4. Finish: Galvanized.
 5. Fabricate grating treads with nosing and with steel angle or steel plate carrier at each end for stringer connections. Secure treads to stringers with bolts.
 6. Fabricate grating platforms with nosing matching that on grating treads. Provide toeplates at open-sided edges of grating platforms. Weld grating to platform framing.

2.7 STAIR RAILINGS

- A. 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.
- B. 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 at

preassembled stairs, and Type 4 welds: good quality, uniform undressed weld with minimal splatter at industrial stairs.

- C. Form changes in direction of railings as follows:
 - 1. By radius bends of radius indicated or by inserting prefabricated elbow fittings of radius indicated.
- D. 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.
- E. Close exposed ends of railing members with prefabricated end fittings.
- F. 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 or less.
- G. 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 galvanized railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.
 - 3. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.
- H. 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. 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.
 - 2. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- D. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products:

1. Exterior Stairs: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 2. Interior Stairs: SSPC-SP 3, "Power Tool Cleaning."
- E. 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 03 30 00 "Cast-in-Place Concrete."
1. Install abrasive nosings with anchors fully embedded in concrete. Center nosings on tread width.

3.2 INSTALLING METAL STAIRS WITH GROUTED BASEPLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of baseplates.
- B. Set steel stair baseplates on wedges, shims, or leveling nuts. After stairs have been positioned and aligned, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
1. Use nonmetallic, nonshrink grout unless otherwise indicated.

2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 INSTALLING RAILINGS

- A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:
 1. Anchor posts to steel by welding directly to steel supporting members.
 2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.
- B. Attach handrails to wall with wall brackets. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt. Provide bracket with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets 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.
 4. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.

3.4 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 dry film thickness.

END OF SECTION 05 51 00

SECTION 05 73 00 - DECORATIVE METAL 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 and iron decorative railings with stainless-steel, wire-rope guard infill.
- B. Related Sections:
 - 1. Section 05 51 00 "Metal Stairs" for steel tube railings included with metal stairs.

1.3 DEFINITIONS

- A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas, pedestrian guidance and support, visual separation, or wall protection.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 - 1. Stainless Steel: 60 percent of minimum yield strength.
 - 2. Steel: 72 percent of minimum yield strength.
- C. Structural Performance: Railings 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. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:

- a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
- b. Infill load and other loads need not be assumed to act concurrently.

1.5 ACTION SUBMITTALS

A. LEED Submittals:

- 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

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

1.6 QUALITY ASSURANCE

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

B. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including structural analysis, preconstruction testing, field testing, and in-service performance.

- 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

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

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

1.7 PROJECT CONDITIONS

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

1.8 COORDINATION AND SCHEDULING

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 suit structural performance requirements.

PART 2 - PRODUCTS

2.1 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: Same metal and finish as supported rails unless otherwise indicated.

2.2 STAINLESS STEEL

- A. Wire Rope and Fittings:
 - 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. Cable Connection (The).
 - b. Feeney Wire Rope & Rigging.
 - c. Loos & Co., Inc.; Cableware Division.
 - 2. Wire Rope: 7-by-7 wire rope made from wire complying with ASTM A 492, Type 316.
 - 3. Wire-Rope Fittings: Connectors fabricated from stainless steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.

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. Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.4 FASTENERS

- A. Fastener Materials: Unless otherwise indicated, provide the following:
 - 1. Stainless-Steel Components: Type 304 stainless-steel fasteners.

2. Uncoated Steel Components: Plated-steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating where concealed; Type 304 stainless-steel fasteners where exposed.
 3. Dissimilar Metals: Type 304 stainless-steel fasteners.
- B. Fasteners for Anchoring 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. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless exposed fasteners are unavoidable.
1. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.
- D. 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, conducted by a qualified independent testing agency.
- E. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

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. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

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. Assemble railings in the shop 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. Make up wire-rope assemblies in the shop to field-measured dimensions with fittings machine swaged. Minimize amount of turnbuckle take-up used for dimensional

adjustment so maximum amount is available for tensioning wire ropes. Tag wire-rope assemblies and fittings to identify installation locations and orientations for coordinated installation.

- D. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- E. Form work true to line and level with accurate angles and surfaces.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.
- I. Form changes in direction as follows:
 - 1. By flush bends.
- J. Close exposed ends of hollow railing members with prefabricated end fittings.
- K. 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 or less.
- L. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

2.7 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.8 STEEL AND IRON FINISHES

- A. Preparing Nongalvanized Items for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."

- B. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 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 indicated.

PART 3 - EXECUTION

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

3.2 RAILING CONNECTIONS

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

3.3 ANCHORING POSTS

- A. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. For steel railings, weld flanges to posts and bolt to metal-supporting surfaces.

3.4 CLEANING

- A. Clean aluminum and stainless steel by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.

- B. 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 for touching up shop-painted surfaces.

- 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

3.5 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05 73 00

SECTION 06 10 53 - MISCELLANEOUS 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. Rooftop equipment bases and support curbs.
 - 2. Wood blocking and nailers.
 - 3. Plywood backing panels.

1.3 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. NeLMA: Northeastern Lumber Manufacturers' Association.
 - 2. NHLA: National Hardwood Lumber Association.
 - 3. NLGA: National Lumber Grades Authority.
 - 4. SPIB: The Southern Pine Inspection Bureau.
 - 5. WCLIB: West Coast Lumber Inspection Bureau.
 - 6. WWPA: 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. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.

4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. LEED Submittals:

1. Certificates for Credit MR 6 Credit MR 7: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
2. Product Data for Credit IEQ 4.1: For adhesives, documentation including printed statement of VOC content.

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. Certified Wood: Lumber and plywood shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
- B. 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 ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC 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.
 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.

- C. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- 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. 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 does not comply with requirements for untreated material.
- C. 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 framing members that are less than 18 inches above the ground in crawl spaces or unexcavated areas.
 - 5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Use treatment that does not promote corrosion of metal fasteners.
 - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.

3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
 - D. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
 - E. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.
 - F. Application: Treat items indicated on Drawings, and the following:
 1. Concealed blocking.
 2. Roof framing and blocking.
 3. Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.
 4. Plywood backing panels.

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.
 3. Rooftop equipment bases and support curbs.
 4. Cants.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber and any of the following species:
 1. Hem-fir (north); NLGA.
 2. Mixed southern pine; SPIB.
 3. Spruce-pine-fir; NLGA.
 4. Hem-fir; WCLIB or WWPA.
 5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
- C. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:
 1. Mixed southern pine, No. 2 grade; SPIB.
 2. Hem-fir or hem-fir (north), Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
 3. 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 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 carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening to Metal Framing: ASTM C 1002 for non-load-bearing framing and ASTM C 954 for load-bearing framing, length as recommended by screw manufacturer for material being fastened.
- F. Lag Bolts: ASME B18.2.1.
- G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 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: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.7 MISCELLANEOUS MATERIALS

- A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Where wood-preserved-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- C. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.
- E. Do not splice structural members between supports unless otherwise indicated.
- F. 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 o.c.
- G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
- H. 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.
- I. Comply with AWPA 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.
- J. Securely attach 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.
- K. 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.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

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 miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 10 53

SECTION 06 16 00 - 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.
 - 2. Composite nail base insulated roof sheathing.
- B. Related Requirements:
 - 1. Section 06 10 53 "Miscellaneous Rough Carpentry" for plywood backing panels.
 - 2. Section 07 27 26 "Fluid-Applied Membrane Air Barriers" for water-resistive barrier applied over wall sheathing.

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.
- B. LEED Submittals:
 - 1. Certificates for Credit MR 6: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
 - 2. Product Data for Credit IEQ 4.1: For adhesives, documentation including printed statement of VOC content.
 - 3. Product Data for Credit IEQ 4.4: For composite wood products, documentation indicating that product contains no urea formaldehyde.

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 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

2.2 WOOD PANEL PRODUCTS

- A. Plywood: DOC PS 1.
- B. Oriented Strand Board: DOC PS 2.
- C. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- D. Factory mark panels to indicate compliance with applicable standard.

2.3 PRESERVATIVE-TREATED PLYWOOD

- 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.
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: Treat all plywood unless otherwise indicated.
 - 1.

2.4 WALL SHEATHING

- A. Plywood Wall Sheathing: Exterior sheathing.
 - 1. Span Rating: Not less than 16/0.
 - 2. Nominal Thickness: Not less than 19/32 inch.

2.5 COMPOSITE NAIL BASE INSULATED ROOF SHEATHING

- A. Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing: Rigid, cellular, polyisocyanurate thermal insulation with oriented strand board laminated to one face complying with ASTM C 1289, Type V.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Atlas Roofing Corporation.
 - b. Cornell Corporation.
 - c. Dow Chemical Company (The).
 - d. Johns Manville; Berkshire Hathaway Inc.
 - e. Rmax, Inc.
 - 2. Polyisocyanurate-Foam Thickness: 2 inches.
 - 3. Oriented-Strand-Board Nominal Thickness: 7/16 inch.

2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. 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.
- E. Screws for Fastening Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing to Metal Roof Deck: Steel drill screws, in type and length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117. Provide washers or plates if recommended by sheathing manufacturer.

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. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
- D. Coordinate wall and roof 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.
- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- 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. Screw to cold-formed metal framing.
 - b. Space panels 1/8 inch apart at edges and ends.

END OF SECTION 06 16 00

SECTION 06 41 16 - 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.
 - 2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.
- B. Related Requirements:
 - 1. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.
 - 2. Section 11 40 00 "Foodservice Equipment" for stainless steel countertop.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product, including high-pressure decorative laminate and cabinet hardware and accessories.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
 - 2. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regionally manufactured materials. Include statement indicating cost for each regionally manufactured material.
 - a. Include statement indicating location of manufacturer and distance to Project for each regionally manufactured material.
 - 3. Product Data for Credit IEQ 4.4: For adhesives and composite wood products, documentation indicating that products contain no urea formaldehyde.
- C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show locations and sizes of furring, blocking, and hanging strips, including

- concealed blocking and reinforcement specified in other Sections.
2. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural plastic-laminate cabinets.

D. Samples for Verification:

1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish.
2. Wood-grain plastic laminates, 8 by 10 inches, for each type, pattern and surface finish.
3. Thermoset decorative panels, 8 by 10 inches, for each color, pattern, and surface finish.

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 between 60 and 90 deg F and relative humidity between 25 and 55percent during the remainder of the construction period.
- B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.
- C. 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. Regional Materials: Plastic-laminate cabinets shall be manufactured within 500 miles of Project site.
- D. Type of Construction: Frameless.
- E. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.
- F. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
 - 1. See 'Millwork Finish Types Legend' on Drawings for product information.
- G. Laminate Cladding for Exposed Surfaces:
 - 1. Horizontal Surfaces: Grade HGS.
 - 2. Postformed Surfaces: Grade HGP.
 - 3. Vertical Surfaces: Grade HGS.
 - 4. Edges: Grade VGS.
 - 5. Pattern Direction: As indicated.
- H. Materials for Semiexposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.
 - a. Edges of Plastic-Laminate Shelves: PVC edge banding, 0.12 inch thick, matching laminate in color, pattern, and finish.
 - b. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.

- c. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.
 - 2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.
 - 3. Drawer Bottoms: Thermoset decorative panels.
- I. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.
- J. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
- K. 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.

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. Medium-Density Fiberboard: ANSI A208.2, Grade 130 , made with binder containing no urea formaldehyde.
 - 2. Particleboard: ANSI A208.1, Grade M-2 Grade M-2, made with binder containing no urea formaldehyde.
 - 3. Softwood Plywood: DOC PS 1, medium-density overlay.
 - 4. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.
 - 5. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.3 FINISHED WOOD VENEER PANELS AND SOLID WOOD TRIM

- A. Wood Veneer Panels: White maple, grade A, plain sliced, book match, with transparent stain.
- B. Solid Wood Trim: White maple, grade A, with transparent stain.

2.4 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 08 71 11 "Door Hardware (Descriptive Specification)."
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening.
- C. Back-Mounted Pulls: BHMA A156.9, B02011.
- D. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter. Satin aluminum finish.
- E. Handle Pull: Hafele; 110.24.001. Contact: Ali Azhar. asazhar@hafeleamericas.com
- F. Shelf Rests: BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip.
- G. Drawer Slides: BHMA A156.9.
 - 1. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-overtravel-extension type; zinc-plated-steel ball-bearing slides.
 - 2. For drawers more than 3 inches high but not more than 6 inches high and not more than 24 inches wide, provide Grade 1HD-100.
 - 3. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-200.
 - 4. For computer keyboard shelves, provide Grade 1HD-100.
- H. Door Locks: BHMA A156.11, E07121.
- I. Drawer Locks: BHMA A156.11, E07041.
- J. Surface-Mounted Countertop Support Brackets:
 - 1. Manufacturer/Supplier:
 - a. www.supportbrackets.com
 - b. Federal Brace; Arrowood Countertop brackets.
 - c. Hafele; Work Surface brackets.
 - 2. Sizes:
 - a. For 18 inch deep counters: 8 by 12 inches.
 - b. For 24 inch deep counters: 15 by 21 inches.
 - c. For 30 inch deep counters: 24 by 24 inches.
- K. Tempered Float Glass for Display Case Doors: ASTM C 1048, Kind FT, Condition A, Type I, Class 1 (clear), Quality-Q3, with exposed edges seamed before tempering, 3/8 inch thick unless otherwise indicated.
- L. Tempered Float Glass for Display Case Shelves: ASTM C 1048, Kind FT, Condition A, Type I, Class 1 (clear), Quality-Q3; with exposed edges seamed before tempering, 1/4 inch thick.
- M. Cable Support System for Display Case Shelves: Nova Display; 2mm cable display system with top and bottom fixings and cables, with shelf supports as required to support

glass shelves shown on Drawings.

- N. Patch Fittings for Display Case Doors: Maximum 4-1/2 inch length; aluminum.
- O. Metal Reveal: 1/4 by 3/4 inches, aluminum.
- P. Steel Post Legs: Stainless steel; 1 inch diameter by 6 inch length.
- Q. Stacking Panel Door: Hafele; Aperto 60/H with custom 90* corner; without bottom track. Accessories include:
 - 1. Lock: 943.04.084
 - 2. Strike: 946.23.920
 - 3. Provide all thumbturns, keys, rosettes, and strike plates required for a complete and functional installation.
 - 4. Contact: Ali Azhar, asazhar@hafeleamericas.com
- R. Vinyl Coated Foam Bench: Custom shape as shown on Drawings.
 - 1. Manufacturers:
 - a. Tenjam, www.tenjam.com, contact: Rae Radovich with Anu Source, 708-218-1861, rae@anusource.com
 - b. Trendway, www.trendway.com/feek, contact: Laura Schlueter, 269-377-6537, LSchlueter@Trendway.com
 - c. Foamtek System, www.foamteksystem.com, contact: Beatrice, +39 0571 920098, Beatrice@foamteksystem.com
 - 2. Product Specifications:
 - a. Fully coated top sides, and bottom.
 - b. Seamless and waterproof finish without vent holes.
 - c. Color(s) to match architect's sample.
 - d. CertiPUR-US Certified Foam substrate.
 - e. Passes fire testing as detailed in California Technical Bulletin 117-2013.
 - f. Compliant with Consumer Product Safety Improvement Act, Section 101: Total Lead in Substrates. Total lead content shall not exceed 0.01% by weight or 100 ppm.
 - g. ASTM4833-07 Puncture Resistance Test. All products must have a coating thickness necessary to achieve a minimum result of 40 lbs.
- S. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. Satin Stainless Steel: BHMA 630.
- T. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.5 MISCELLANEOUS MATERIALS

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

- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesives: Do not use adhesives that contain urea formaldehyde.
- D. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
 - 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.6 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. 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.
- 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 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 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 o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch 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 06 41 16

SECTION 06 64 00 - PLASTIC PANELING

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 glass-fiber reinforced plastic (FRP) wall paneling and trim accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.
 - 2. Product Data for Credit IEQ 4.4: For laminating adhesive[and composite wood products] used in factory-laminated plastic panels, documentation indicating that product contains no urea formaldehyde.
- C. Samples for Initial Selection: For plastic paneling and trim accessories.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.
- B. 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. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.
 - 3. Testing Agency: UL.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PLASTIC SHEET PANELING

- A. General: Gelcoat-finished, glass-fiber reinforced plastic panels complying with ASTM D 5319.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kemlite Company Inc.
 - b. Marlite.
 - c. Nudo Products, Inc.
 - 2. Nominal Thickness: Not less than 0.09 inch.
 - 3. Surface Finish: Smooth.
 - 4. Color: White.

2.2 ACCESSORIES

- A. Trim Accessories: Manufacturer's standard two-piece, snap-on vinyl extrusions designed to cover edges of panels. Provide division bars, inside corners, and caps as needed to conceal edges.
 - 1. Color: Match panels .
- B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.
- C. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.
- D. Adhesive: As recommended by plastic paneling manufacturer.
 - 1. Adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Sealant: Single-component, mildew-resistant, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 07 92 00 "Joint Sealants."
- F. Retain first subparagraph below if required for LEED-NC, LEED-CI or LEED-CS Credit IEQ 4.1.
 - 1. Sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.
- B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.
- C. Clean substrates of substances that could impair bond of adhesive, including oil, grease, dirt, and dust.
- D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.
- E. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels.
 - 1. Mark plumb lines on substrate at trim accessory locations for accurate installation.
 - 2. Locate trim accessories to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

- A. Install plastic paneling according to manufacturer's written instructions.
- B. Install panels in a full spread of adhesive.
- C. Install panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned.
 - 1. Drill oversized fastener holes in panels and center fasteners in holes.
 - 2. Apply sealant to fastener holes before installing fasteners.
- D. Install factory-laminated panels using concealed mounting splines in panel joints.
- E. Install trim accessories with adhesive .
- F. Fill grooves in trim accessories with sealant before installing panels and bed inside corner trim in a bead of sealant.

- G. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
- H. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.
- I. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 06 64 00

SECTION 07 21 00 - 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. Foam-plastic board insulation.
 - 2. Spray polyurethane foam insulation.
- B. Related Sections:
 - 1. Section 04 20 00 "Unit Masonry" for insulation installed in masonry cells.
 - 2. Section 07 53 23 "Ethylene-Propylene-Diene-Monomer (EPDM) Roofing" for insulation specified as part of roofing construction.
 - 3. Section 09 21 16.23 "Gypsum Board Shaft Wall Assemblies" for installation in wood- and metal-framed assemblies of insulation specified by referencing this Section.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

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.

- B. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
 - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
 - 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. DiversiFoam Products.
 - b. Dow Chemical Company (The).
 - c. Owens Corning.
 - d. Pactiv Building Products.
 - 2. Type IV, 25 psi.
- B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

2.2 SPRAY POLYURETHANE FOAM INSULATION

- A. Closed-Cell Polyurethane Foam Insulation: ASTM C 1029, Type II, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
 - 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. BASF Corporation.
 - b. Dow Chemical Company (The).
 - c. Gaco Western Inc.
 - d. Henry Company.
 - 2. Minimum density of 1.5 lb/cu. ft., thermal resistivity of 6.2 deg F x h x sq. ft./Btu x in. at 75 deg F.

2.3 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.
 - 1. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - 2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.
- B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.
 - 1. Angle: Formed from 0.030-inch- thick, perforated, galvanized carbon-steel sheet with each leg 2 inches square.
 - 2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.
- C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
 - 1. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
 - a. Ceiling plenums.
- D. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.

3.2 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.

3.3 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. Foam-Plastic Board Insulation: Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.
- C. Spray-Applied Insulation: Apply spray-applied insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.
- D. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.4 PROTECTION

- A. Protect installed insulation[and vapor retarders] from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

3.5 INSULATION SCHEDULE

- A. Type IV extruded-polystyrene board insulation:
 - 1. For use as thermal insulation at exterior walls.
- B. Polyurethane spray foam insulation:
 - 1. For use in miscellaneous voids and cavity spaces where required to prevent gaps in insulation at exterior enclosure, and at other locations where indicated on drawings.

END OF SECTION 07 21 00

SECTION 07 27 26 - FLUID-APPLIED MEMBRANE AIR BARRIERS

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 fluid-applied, vapor-permeable membrane air barriers.
- B. Related Requirements:
 - 1. Section 06 16 00 "Sheathing" for wall sheathings.

1.3 DEFINITIONS

- A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.
- B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.
- C. Air-Barrier Assembly: The collection of air-barrier materials and accessory materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.2: For air-barrier products, documentation including printed statement of VOC content.

- C. Shop Drawings: For air-barrier assemblies.
 - 1. Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 - 2. Include details of interfaces with other materials that form part of air barrier.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
 - 1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.
- B. Mockups: Build mockups to set quality standards for materials and execution.
 - 1. Build integrated mockups of exterior wall assembly , 150 sq. ft., incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
 - a. Coordinate construction of mockups to permit inspection by Owner's testing agency of air barrier before external insulation and cladding are installed.
 - b. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
 - c. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air-barrier manufacturer.
 - 1. Protect substrates from environmental conditions that affect air-barrier performance.
 - 2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.
- B. VOC Content: 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and complying with VOC content limits of authorities having jurisdiction.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Air barrier shall be capable of performing as a continuous vapor-retarding air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 2357.

2.3 VAPOR-PERMEABLE MEMBRANE AIR-BARRIER

- A. Fluid-Applied, Vapor-Permeable Membrane Air Barrier: synthetic polymer membrane.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Synthetic Polymer Membrane:
 - 1) BASF; Enershield HP.
 - 2) Carlisle Coatings & Waterproofing Inc.; Barritech VP.
 - 3) Grace, W. R., & Co. - Conn.; Perm-A-Barrier VP.
 - 4) Henry Company; Air-Bloc 31 or Air-Bloc 33.
 - 5) Rubber Polymer Corporation, Inc.; Rub-R-Wall Airtight VP.
 - 6) Sto Corp.; StoGuard.
 - 7) Tremco Incorporated, an RPM company; ExoAir 230.
 - 2. Physical and Performance Properties:
 - a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
 - b. Vapor Permeance: Minimum 10 perms; ASTM E 96/E 96M.
 - c. Ultimate Elongation: Minimum 200 percent; ASTM D 412, Die C.

2.4 ACCESSORY MATERIALS

- A. General: Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier material.
- B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.
- C. Counterflashing Strip: Modified bituminous, 40-mil- thick, self-adhering sheet consisting of 32 mils of rubberized asphalt laminated to an 8-mil- thick, cross-laminated polyethylene film with release liner backing.
- D. Butyl Strip: Vapor retarding, 30 to 40 mils thick, self-adhering; polyethylene-film-reinforced top surface laminated to layer of butyl adhesive with release liner backing.
- E. Joint Reinforcing Strip: Air-barrier manufacturer's glass-fiber-mesh tape.
- F. Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
- G. Adhesive and Tape: Air-barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.
- H. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0250 inch thick, and Series 300 stainless-steel fasteners.
- I. Sprayed Polyurethane Foam Sealant: One- or two-component, foamed-in-place, polyurethane foam sealant, 1.5- to 2.0-lb/cu. ft density; flame-spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.
- J. Adhesive-Coated Transition Strip: Vapor-permeable, 17-mil- thick, self-adhering strip consisting of an adhesive coating over a permeable laminate with a permeance value of 37 perms.
- K. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Section 07 92 00 "Joint Sealants."
- L. Termination Mastic: Air-barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.

2. Verify that concrete has cured and aged for minimum time period recommended by air-barrier manufacturer.
 3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.
- E. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- F. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 JOINT TREATMENT

- A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air-barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.
 1. Prime substrate and apply a single thickness of air-barrier manufacturer's recommended preparation coat extending a minimum of 3 inches along each side of joints and cracks. Apply a double thickness of fluid air-barrier material and embed a joint reinforcing strip in preparation coat.
- B. Sheathing: Fill joints greater than 1/4 inch with sealant according to ASTM C 1193 and air-barrier manufacturer's written instructions. Apply first layer of fluid air-barrier material at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air-barrier material over joint reinforcing strip.

3.4 TRANSITION STRIP INSTALLATION

- A. General: Install strips, transition strips, and accessory materials according to air-barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.
 1. Coordinate the installation of air barrier with installation of roofing membrane and

- base flashing to ensure continuity of air barrier with roofing membrane.
2. Install [butyl] modified bituminous strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
- B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
 1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
 - C. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
 - D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
 - E. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
 - F. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply modified bituminous transition strip [adhesive-coated transition strip] elastomeric flashing sheet preformed silicone-sealant extrusion so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.
 1. Adhesive-Coated Transition Strip: Roll firmly to enhance adhesion.
 - G. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
 - H. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
 - I. Seal top of through-wall flashings to air barrier with an additional 6-inch- wide, counterflashing strip.
 - J. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
 - K. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.5 FLUID AIR-BARRIER MEMBRANE INSTALLATION

- A. General: Apply fluid air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions. Apply fluid air-barrier material within manufacturer's recommended application temperature ranges.

1. Apply primer to substrates at required rate and allow it to dry.
 2. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
- B. Membrane Air Barriers: Apply a continuous unbroken air-barrier membrane to substrates according to the following thickness. Apply air-barrier membrane in full contact around protrusions such as masonry ties.
1. Vapor-Permeable Membrane Air Barrier: Total dry film thickness as recommended in writing by manufacturer to meet performance requirements, but not less than 40-mil dry film thickness, applied in one or more equal coats.
- C. Apply strip and transition strip a minimum of 1 inch onto cured air-barrier material or strip and transition strip over cured air-barrier material overlapping 3 inches onto each surface according to air-barrier manufacturer's written instructions.
- D. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.
- E. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements.
- C. Tests: As determined by Owner's testing agency from among the following tests:
1. Quantitative Air-Leakage Testing: Air-barrier assemblies will be tested for air leakage according to ASTM E 783.
- D. Air barriers will be considered defective if they do not pass tests and inspections.
1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
 2. Remove and replace deficient air-barrier components for retesting as specified above.
- E. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

3.7 CLEANING AND PROTECTION

- A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than 30 days, remove and replace air barrier or install additional, full-thickness, air-barrier

- application after repairing and preparing the overexposed membrane according to air-barrier manufacturer's written instructions.
2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.
 - C. Remove masking materials after installation.

END OF SECTION 07 27 26

SECTION 07 42 13 - FLATLOCK METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Factory-formed, zinc-alloy, metal wall panel system.
- B. Related Sections:
 - 1. Section 06 10 53 – Miscellaneous Rough Carpentry.
 - 2. Section 07 21 00 – Thermal Insulation: Wall insulation.
 - 3. Section 07 27 26 – Fluid-Applied Membrane Air Barriers.
 - 4. Section 07 62 00 – Sheet Metal Flashing and Trim: Fascia, copings, flashings, and other sheet metal work.
 - 5. Section 07 92 00 – Joint Sealants.

1.2 REFERENCES

- A. ASTM B 32 – Standard Specification for Solder Metal.
- B. ASTM D 968 – Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive.
- C. ASTM D 1970 – Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
- D. ASTM E 96 – Standard Test Methods for Water Vapor Transmission of Materials.

1.3 SYSTEM DESCRIPTION

- A. Provide complete Flatlock metal wall panel system as indicated, including:
 - 1. Factory-formed, zinc-alloy, metal wall panels.
 - 2. Attachment system components.
 - 3. Weather-resistive barrier materials.
- B. Thermal Movements:
 - 1. Provide metal wall panel system that allows for thermal movements.
 - 2. Provide clips that resist rotation and avoid shear stress as a result of metal wall panel system thermal movements.

1.4 SUBMITTALS

- A. Comply with Section 01 33 00 – Submittal Procedures.

- B. Product Data: Submit panel manufacturer's product data, including details of construction relative to materials, dimensions of individual components and profiles, finishes, and panel manufacturer's written and published installation instructions and installation guides.
- C. LEED Certification: Submit manufacturers certification for each product including the following:
 - 1. LEED Credit MRc 4.1/4.2 - Recycled content, including percentage of preconsumer (post industrial) and post-consumer recycled content. Also provide manufacturer's name and product cost.
- D. Shop Drawings: Submit installer's shop drawings as verified by manufacturer, including plans, elevations, sections, and details, indicating installation layout of metal wall panel system, with keyed references to termination points. Include the following:
 - 1. Details of metal wall panels, including dimensions.
 - 2. Details for joining and securing metal wall panel system, including layout of fasteners, clips, and other attachments. Include pattern of seams.
 - 3. Details of wall penetrations.
 - 4. Details of special conditions.
 - 5. Details of connections to adjoining work.
 - 6. Details of required accessory items.
 - 7. Metal wall panel system.
- E. Samples for Verification: Submit panel manufacturer's samples for each type of exposed component required, including:
 - 1. Metal Wall Panel System: Minimum 24 inches (600 mm) long by standard panel width, including finished seams. Include fasteners and clips.
 - 2. Trim and Closures: 24" long (600 mm) sample of each type of trim and closure, including fasteners cleats and components.
 - 3. Accessories: 24" (600 mm) long sample of each type of accessory.
- F. Qualification Data: Submit qualification data for panel manufacturer and installer to demonstrate capabilities and experience. Refer to AIA A305 Qualification Form as guide for submittal.
- G. Warranties: Submit warranties from:
 - 1. Manufacturer.
 - 2. Installer.

1.5 QUALITY ASSURANCE

- A. Panel Manufacturer's Qualifications: Manufactured a minimum of 250,000 square feet of metal wall panel systems of similar type to that specified.
- B. Installer's Qualifications:
 - 1. Engage an experienced installer who has completed metal wall panel system installation similar in material, design, forming method, and extent to that indicated for this Project and with a record of successful in-service performance.

2. Provide evidence of the field installer's participation in manufacturer's training course.
- C. Metal Wall Panel System Standard: Comply with panel manufacturer's written and published instructions.
- D. Mock-ups:
1. Before installing metal wall panel system, construct mock-ups. Verify selection made under sample submittals and demonstrate aesthetic effects and qualities of materials and execution as required by Architect.
 2. Build mock-ups to comply with the following requirements:
 - a. Construct mock-ups in location and of size as directed by Architect.
 - b. Receive approval of mock-ups by Architect in writing.
 - c. Approval of mock-ups does not constitute approval of deviations from the Contract Documents contained in mock-ups, unless such deviations are specifically approved by Architect in writing.
 - d. Approved mock-ups may become part of the completed Work, if undisturbed at time of Substantial Completion and approved by Architect in writing.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery:
1. Inspect delivered materials within 5 days from date of delivery. Report damaged materials to panel manufacturer within 5 days.
 2. Deliver materials to site in panel manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and panel manufacturer.
 3. Deliver materials so as not to be damaged or deformed.
 4. Package metal wall panels for protection during transportation and handling.
 5. Leave strippable protective UV-resistant film on metal wall panels.
- B. Storage and Handling:
1. Store materials in clean areas in accordance with manufacturer's instructions.
 2. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

1.7 PROJECT CONDITIONS

- A. Weather Limitations: Install metal wall panel system only when weather conditions permit installation in accordance with manufacturer's instructions.

1.8 WARRANTY

- A. Warranty Period:
1. Materials: 5 years from date of Substantial Completion. (Provided by the Panel Manufacturer.)

2. Installation: 2 years from date of Substantial Completion. (Provided by the Installer.)

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Product: Subject to compliance with requirements, provide Umicore Building Products USA, Inc. (630-655-9100); VM Zinc flatlock metal wall panels.

2.2 METAL WALL PANELS

- A. Zinc Alloy: 99.995 percent electrolytic high-grade zinc with alloy additives of copper (0.08 percent to 0.20 percent), titanium (0.07 percent to 0.12 percent), and aluminum (0.015 percent).

1. Thickness: 0.039 inch (1.00 mm).
2. Surface Aspect:
 - a. Color 1: Preweathered Zinc: "QUARTZ ZINC". Dark gray zinc with luminance Y between 22 and 25 on exposed side or architect approved equal color management system.
 - b. Color 2: Preweathered Zinc: "ANTHRA ZINC". Charcoal black zinc with luminance Y between 5 and 7 on exposed sides or architect approved equal color management system.
3. Dimensional Tolerances:
 - a. Coverage: Plus or minus 1/8 inch (3 mm).
 - b. Flatness: 1/8 inch (3 mm) on 36 inches (914 mm).
 - c. Curvature: 1/32" (0.8mm).

- B. Metal Wall Panels:

1. Form with flat-lock seam at panel edges and smooth, flat pan.
2. Field install in sequential order.
3. Engage lower edge of each panel to upper edge of panel below and engage right side of preceding panel's left side.
4. Mechanically attach panels to supports using concealed clips engaged in upper and left seams of panels.

2.3 WEATHER-RESISTIVE BARRIER MATERIALS

- A. Available Products: Subject to compliance with requirements, weather-resistive barrier materials that may be incorporated into the Work include, but are not limited to, the materials specified.
- B. Hydrophobic Weather-Resistive Barrier:
 1. Fabric Underlayment:

- a. Type: High-permeability, spun-bonded, non-woven, polypropylene fabric.
- b. Weight: 6.103 oz/sq. yd (175grams/sq.m)
- c. Thickness: 0.023 inch (0.60 mm)
- d. Water Vapor Transmission, ASTM E 96, Method A: 212 perms.

2. Acceptable Products:

- a. VM Zinc Compatible Weather Barrier.
- b. Fabric underlayment approved by the panel manufacturer.

C. Flashing Membrane: Self-adhering, high-temperature sheet:

- 1. Slip-resisting, polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied.
- 2. Minimum Thickness: 30 to 40 mils (0.76 to 1.0 mm).
- 3. Provide primer when recommended by flashing membrane manufacturer.
- 4. Thermal Stability, ASTM D 1970, 240 degrees F (116 degrees C): Stable.
- 5. Low Temperature Flexibility, ASTM D 1970, Minus 20 degrees F (29 degrees C): Passes.
- 6. Available Products:
 - a. Carlisle Coatings & Waterproofing, Div. of Carlisle Companies Inc.; CCW WIP 403HR High Performance Underlayment.
 - b. Grace, W. R. & Co.; "Vycor Ultra HT".

2.4 THERMAL INSULATION

- A. Insulation: As specified in Section 07 21 00.

2.5 CLIPS AND FASTENERS FOR METAL WALL PANELS

A. Clips:

- 1. Hot dip galvanized steel or 300 series stainless steel.
- 2. Pre-punched for attachment into substrate.
- 3. Thickness: 0.020" (0.5mm).
- 4. Designed to withstand negative load requirements.

B. Fasteners for clip attachment to steel substrate:

- 1. #12, hot dip galvanized steel or 300 series stainless steel, thread design and length appropriate for substrate.

C. Fasteners for clip attachment to wood substrate:

- 1. #12, 300 series stainless steel, thread design and length appropriate for substrate.

D. Exposed Fasteners:

- 1. Self tapping screws, bolts, self locking rivets and other suitable fasteners designed to withstand design loads.

2. Material: 300 series stainless steel.
3. Heads: Factory applied coating to match color of metal.

2.6 ACCESSORIES

A. Flashing and Trim:

1. Shop or Field-fabricated from zinc-alloy sheets.
2. Minimum Thickness: 0.031 inch (0.80mm).
3. Seal against weather.
4. Provide finished appearance.
5. Provide pull-out resistance and flatness.
6. Match surface aspect of adjacent metal wall panels.
7. Flashing Backside Coating:
 - a. Coating Thickness: 60 microns.
 - b. Abrasion Resistance, ASTM D 968, Method D: 140 liters.
8. Backer plates: Provide metal backing plates at panel edges, terminations, openings, splices, and where recommended by manufacturer, consisting of Zinc Plus or stainless steel sheet goods formed in configuration and thickness recommended by manufacturer.
9. Cleats: Continuous G90 galvanized cleats, formed in configuration, and thickness as recommended by the manufacturer, minimum 0.0239" (0.60mm)
10. Ventilation screen: 51% open perforated zinc, 0.039" (1.00mm) thickness, by metal wall panel manufacturer.

B. Exposed Fasteners:

1. Self tapping screws, bolts, self locking rivets and other suitable fasteners designed to withstand design loads.
2. Material: 300 series stainless steel.
3. Heads: Factory applied coating to match color of metal.

C. Solder and Stripping for Accessories:

1. Solder for Zinc-Alloy: ASTM B 32, 60 percent lead and 40 percent tin with low antimony, as recommended by manufacturer.
2. Stripping:
 - a. "Stay-Clean" soldering flux for removal of zinc-alloy preweathering layer.
 - b. Abrasive disc for removal of backside coating.

PART 3 - EXECUTION

3.1 EXAMINATION

- #### A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of work.
1. Verify that substrate is plumb, sound, dry, smooth, clean, sloped for drainage,

- and completely anchored, and that provision has been made for wall drains, flashings, and penetrations through metal wall panels.
2. Examine primary and secondary wall framing to verify that purlins, angles, channels, and other structural panel support members and anchorages have been installed correctly.
 3. Prepare written report, endorsed by installer, listing conditions detrimental to performance of Work of this section. Submit copy of report to Architect.
- B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before wall panel installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install metal wall panel in accordance with manufacturer's written and published instructions and installation guides.
- B. Install panels in orientation and locations indicated on the Drawings.
1. Locations include, but are not limited to:
 - a. Top of wall (parapet, copings).
 - b. Corners.
 - c. Bases.
 - d. Framed openings.
 - e. Fascias.
 - f. Fillers.
 - g. Starter and termination edge trims.
 - h. Junction and reveal trims.
 - i. Starter and termination trims.
 - j. Zee closure trims.
- C. Install metal wall panels plumb, level, square, true to line, and within installation tolerances.
- D. Self-Adhering Sheet Underlayment:
1. Install underlayment per manufacturer's recommendations.
 2. Lay in shingle fashion to shed water, lapping joints, edges, per manufacturer's recommendations.
 3. Apply primer to sheathing substrates, per manufacturer's recommendations.
 4. Overlap sides and edges, and stagger per manufacturer's recommendations.
 5. Roll laps and field of underlayment to provide a wrinkle free installation.
- E. Underlayment Installation:
1. Install and fasten fabric underlayment per manufacturer's recommendations.
 2. Lay in shingle fashion to shed water, lapping joints, edges, minimum of 6" (150 mm) . Cover underlayment within 60 days.
- F. Panel Installation:

1. Install metal wall panels perpendicular to girts and subgirts, unless otherwise indicated.
 2. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 3. Do not field-cut metal wall panels by torch.
 4. Fasten metal wall panels in accordance with manufacturer's instructions.
 5. Flash and seal metal wall panels with weather closure edges and at perimeter of openings.
 6. Install flashing and trim as metal wall panel work proceeds.
 7. Fasten flashings and trim around openings and similar elements.
 8. Do not allow construction debris to contaminate metal wall panels.
- G. Fasteners: Use fasteners of type and size (per Manufacturer Recommendations) that will secure roof components in compliance with design load requirements.
- H. Conceal fasteners and expansion provisions, where possible, in exposed work and locate to minimize possibility of leakage.
- I. Fasten metal wall panels to substrate supports with concealed clips at each flat-lock joint at location, spacing, and with fasteners in accordance with manufacturer's instructions.
1. Install clips to supports with specified fasteners.
 2. Nest flat-lock seams and fasten together by interlocking.
 3. Form laps and joints to shed water.
- J. Metal Protection: Do not install metal wall panel system with non-compatible materials. Protect the metal wall panels from masonry and products containing lime by leaving the protective coating on the zinc until project and clean-up completion.

3.3 TOLERANCES

- A. Installation Tolerances:
1. Maximum Alignment per Panel Variation: 1/8 inch (3 mm).

3.4 CLEANING

- A. Clean exposed metal surfaces in accordance with manufacturer's instructions.
- B. Remove protective films within 60 days of installation.
- C. Clean and neutralize flux materials. Remove excess solder.
- D. Clean finished surfaces on completion of metal wall panel installation, including removing unused fasteners, metal filings, rivet stems, and pieces of flashing.
- E. Maintain metal wall panels in clean condition during construction, removing all film per elevation on the same day.

3.5 PROTECTION

- A. Protect installed metal wall panel system as per manufacturer's recommendation to ensure that, except for normal weathering, panel system will be without damage or deterioration at time of Substantial Completion.

END OF SECTION 07 42 13

SECTION 07 42 13.13 - FORMED METAL WALL 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 wall panels.
- B. Related Sections:
 - 1. Section 07 42 13 "Flatlock Metal Wall Panels" for flatlock metal wall panels.
 - 2. Section 07 42 43 "Composite Wall Panels" for metal-faced composite wall panels.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
- C. 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.
- D. Samples for Initial Selection: For each type of metal panel indicated with factory-applied finishes.
- E. Samples for Verification: For each type of exposed finish.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels 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.

1.6 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.

1.7 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.

1.8 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. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. 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: As indicated on Drawings.
 2. Other Design Loads: As indicated on Drawings.
 3. Deflection Limits: For wind loads, no greater than 1/240 of the span.
- 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, ambient; 180 deg F, material surfaces.

2.2 EXPOSED-FASTENER, LAP-SEAM METAL WALL PANELS

- A. General: Provide factory-formed metal panels designed to be field assembled 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. Tapered-Rib-Profile, Exposed-Fastener Metal Wall Panels : Formed with raised, trapezoidal major ribs and a flat pan between major ribs.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Pac-Clad; 7.2 Panel, or comparable product by one of, but not limited to, the following:
 - a. Architectural Metal Systems; a Nucor company.
 - b. Firestone Metal Products, LLC.
 - c. MBCI; a division of NCI Building Systems, L.P.
 2. Aluminum Sheet: Coil-coated sheet, ASTM B 209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.

- a. Thickness: 0.050 inch.
 - b. Surface: Smooth, flat finish.
 - c. Color: As selected by Architect from manufacturer's full range.
- 3. Major-Rib Spacing: 7.2 inches o.c.
 - 4. Panel Coverage: 36 inches.
 - 5. Panel Height: 1.5 inches.

2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. 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. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 - 2. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. 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, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- D. 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.
- E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
 - 1. 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. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. 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.
- D. 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 Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 - 4. 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 wall 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 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 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 wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall 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. Install screw fasteners in predrilled holes.
 - 3. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 4. Install flashing and trim as metal panel work proceeds.
 - 5. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 - 6. 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.
 - 7. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
 - 1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or 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.
- 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 wall panel manufacturer; or, if not indicated, provide types recommended 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 as indicated. 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 with no joints allowed within 24 inches 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 deep, filled with mastic sealant (concealed within joints).

3.4 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. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 42 13.13

SECTION 07 42 43 - COMPOSITE WALL 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 metal-faced composite wall panels.
- B. Related Sections:
 - 1. Section 05 40 00 "Cold-Formed Metal Framing" for cold-formed metal framing supporting metal-faced composite wall panels.
 - 2. Section 07 42 13 "Flatlock Metal Wall Panels" for flatlock metal wall panels.
 - 3. Section 07 42 13.13 "Formed Metal Wall Panels" for tapered rib panel at roof screen wall.
 - 4. Section 07 62 00 "Sheet Metal Flashing and Trim" for field-formed flashings and other sheet metal work not part of metal-faced composite wall panel assemblies.

1.3 DEFINITION

- A. Metal-Faced Composite Wall Panel Assembly: Metal-faced composite wall panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete weathertight wall system.

1.4 PERFORMANCE REQUIREMENTS

- A. General Performance: Metal-faced composite wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Delegated Design: Design metal-faced composite wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of wall area when tested according to ASTM E 283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 1.57 lbf/sq. ft..
- D. Water Penetration Under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft..

- E. Structural Performance: Provide metal-faced composite wall panel assemblies capable of withstanding the effects of the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:
1. Wind Loads: Determine loads based on the following minimum design wind pressures:
 - a. Uniform pressure of 30 lbf/sq. ft., acting inward or outward.
 - b. Uniform pressure as indicated on Drawings.
 2. Deflection Limits: Metal-faced composite wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/175 of the span at the perimeter and 1/60 of the span anywhere in the panel.
- F. 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, ambient; 180 deg F, material surfaces.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal-faced composite wall panel and accessory.
- B. Shop Drawings: Show fabrication and installation layouts of metal-faced composite wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish among factory-, shop-, and field-assembled work.
1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
 - a. Flashing and trim.
 - b. Anchorage systems.
- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
1. Metal-Faced Composite Wall Panels: Minimum 12 x 12 inches. Include fasteners, closures, and other metal-faced composite wall panel accessories.
 2. Trim and Closures: 12 inches long. Include fasteners and other exposed accessories.
 3. Accessories: 12-inch- long Samples for each type of accessory.
 4. Exposed Gaskets: 12 inches long.
 5. Exposed Sealants: For each type and color of joint sealant required. Install joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of metal-faced composite wall panels adjacent to joint sealants.

- D. LEED Certification: Submit manufacturers certification for each product including the following:
 - 1. LEED Credit MRc 4.1/4.2 - Recycled content, including percentage of preconsumer (post industrial) and post-consumer recycled content. Also provide manufacturer's name nad product cost.
 - 2. LEED Credit MRc 5.1/5.2 - Location of manufacturing plant, manufacturer's name, product cost and location of extraction or harvest of raw materials.

1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Exterior elevations, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Wall panels and attachments.
 - 2. Girts and Stud framing.
 - 3. Wall-mounted items including doors, windows, louvers, and lighting fixtures.
 - 4. Penetrations of wall by pipes and utilities.
- B. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- C. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

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

1.8 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of metal-faced composite wall panel from single source from single manufacturer.
 - 1. Color matching between the composite wall panel, flatlock metal wall panel - color 2, and associated sheet metal flashing, is vital. Use same manufacturer of zinc metal for all products of the same zinc color.
- B. Preconstruction Compatibility and Adhesion Testing: Submit samples of materials that will contact joint sealants to joint-sealant manufacturers for testing indicated in subparagraphs below:
 - 1. Use manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

- a. Perform tests under environmental conditions replicating those that will exist during installation.
 2. Submit no fewer than nine pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
 3. Schedule enough time for testing and analyzing results to prevent delaying the Work.
 4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
- C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 1. Build mockup of typical wall panel as shown on Drawings; including supports, attachments, and accessories.
 - a. Include four-way joint for metal-faced composite wall panels.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- D. Preinstallation Conference: Conduct conference at Project site.
 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal-faced composite wall panel Installer, metal-faced composite wall panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal-faced composite wall panels including installers of doors, windows, and louvers.
 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-faced composite wall 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 flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal-faced composite wall panels.
 6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 7. Review temporary protection requirements for metal-faced composite wall panel assembly during and after installation.
 8. Review wall panel observation and repair procedures after metal-faced composite wall panel installation.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, sheets, metal-faced composite wall panels, and other manufactured items so as not to be damaged or deformed. Package metal-faced composite wall panels for protection during transportation and handling.

- B. Unload, store, and erect metal-faced composite wall panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Store metal-faced composite wall panels vertically, covered with suitable weathertight and ventilated covering. Store metal-faced composite wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal-faced composite wall panels in contact with other materials that might cause staining, denting, or other surface damage. Do not allow storage space to exceed 120 deg F.
- D. Retain strippable protective covering on metal-faced composite wall panel for period of panel installation.

1.10 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal-faced composite wall panels to be performed according to manufacturer's written instructions and warranty requirements.
- B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal-faced composite wall panel fabrication and indicate measurements on Shop Drawings.

1.11 COORDINATION

- A. Coordinate metal-faced composite wall panel assemblies with rain drainage work, flashing, trim, and construction of studs, soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.12 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal-faced composite wall panel assemblies 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-faced composite wall 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.

PART 2 - PRODUCTS

2.1 PANEL MATERIALS

- A. Zinc Sheet: Provide Umicore Building Products USA, Inc.; VM Zinc metal sheet.
 1. Color 1: Quartz Zinc.
 2. Color 2: Anthra-Zinc.
- B. Panel Sealants:
 1. Joint Sealant: ASTM C 920; silicone sealant; of type, grade, class, and use classifications required to seal joints in metal-faced composite wall panels and remain weathertight; and as recommended in writing by panel manufacturer.

2.2 MISCELLANEOUS METAL FRAMING

- A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G60 hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.
- B. Subgirts: Manufacturer's standard C- or Z-shaped sections 0.064-inch nominal thickness.
- C. Zee Clips: 0.079-inch nominal thickness.
- D. Base or Sill Channels: 0.079-inch nominal thickness.
- E. Hat-Shaped, Rigid Furring Channels:
 1. Nominal Thickness: As required to meet performance. requirements.
 2. Depth: As required.
- F. Cold-Rolled Furring Channels: Minimum 1/2-inch- wide flange.
 1. Nominal Thickness: As required to meet performance requirements.
 2. Depth: As required.
 3. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with nominal thickness of 0.040 inch.
 4. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch- diameter wire.
- G. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

2.3 MISCELLANEOUS MATERIALS

- A. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and finish indicated.
- B. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal-faced composite wall panels by means of plastic caps or factory-applied coating. Provide neoprene sealing washers.

2.4 METAL-FACED COMPOSITE WALL PANELS

- A. General: Provide factory-formed and -assembled, metal-faced composite wall panels fabricated from two metal facings bonded, using no glues or adhesives, to solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment system components and accessories required for weathertight system.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Alcoa Inc.; Reynobond ZCM.
 - b. Custom Metal Contracting, Inc.; Composite Panel System, series 10.
 - c. Sobotec; SL-1000.
- B. Attachment System Components: Formed from material compatible with panel facing.
 - 1. Include manufacturer's standard perimeter extrusions with integral weather stripping, panel stiffeners, panel clips, and anchor channels.

2.5 ACCESSORIES

- A. Wall Panel Accessories: Provide components required for a complete metal-faced composite wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal-faced composite wall panels unless otherwise indicated.
- B. Flashing and Trim: Formed from 0.018-inch- minimum thickness, in material compatible with panel facing. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal-faced composite wall panels.

2.6 FABRICATION

- A. General: Fabricate and finish metal-faced composite wall panels and accessories at the factory to greatest extent possible, 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. Fabricate metal-faced composite wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.
- C. Metal-Faced Composite Wall Panels: Factory form panels in a continuous process with no glues or adhesives or batch process by laminating each sheet using glues or adhesives between dissimilar materials. Trim and square edges of sheets with no displacement of face sheets or protrusion of core material.
 - 1. Form panel lines, breaks, and angles to be sharp and true, with surfaces free from warp and buckle.
 - 2. Fabricate panels with sharply cut edges, with no displacement of face sheets or protrusion of core material.
 - 3. Fabricate panels with panel stiffeners, as required to comply with deflection limits, attached to back of panels with structural silicone sealant or bond tape.
 - 4. Dimensional Tolerances:
 - a. Panel Bow: 0.8 percent maximum of panel length or width.
 - b. Squareness: 0.25 inch maximum.
- D. Sheet Metal Accessories: Fabricate flashing and trim to comply with 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 elastomeric sealant 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 by metal-faced composite wall panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal-faced composite wall panel manufacturer for application, but not less than thickness of metal being secured.

2.7 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. 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 substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal-faced composite wall panel supports, and other conditions affecting performance of the Work.
 - 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal-faced composite wall panel manufacturer.
 - 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal-faced composite wall panel manufacturer.
 - 3. Verify that weather barrier has been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal-faced composite wall panels to verify actual locations of penetrations relative to seam locations of panels before panel installation.
- C. For the record, 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. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorage according to ASTM C 754 and metal-faced composite wall panel manufacturer's written instructions.

3.3 METAL-FACED COMPOSITE WALL PANEL INSTALLATION

- A. General: Install metal-faced composite wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Commence metal-faced composite wall panel installation and install minimum of 300 sq. ft. in presence of factory-authorized representative.
 - 2. Shim or otherwise plumb substrates receiving metal-faced composite wall panels.
 - 3. Flash and seal metal-faced composite wall panels at perimeter of all openings. Do not begin installation until weather barrier and flashings that will be concealed by panels are installed.
 - 4. Install flashing and trim as metal-faced composite wall panel work proceeds.
 - 5. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.

6. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal-faced composite wall panel manufacturer.
- C. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal-faced composite wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by panel manufacturer.
 1. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."
- D. Attachment System Installation, General: Install attachment system required to support metal-faced composite wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
 1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
 2. Do not begin installation until weather barrier and flashings that will be concealed by composite panels are installed.
- E. Clip Installation: Attach panel clips to supports at each metal-faced composite wall panel joint at locations, spacings, and with fasteners recommended by manufacturer. Attach routed-and-turned flanges of wall panels to panel clips with manufacturer's standard fasteners.
 1. Seal horizontal and vertical joints between adjacent panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Section 079200 "Joint Sealants."

3.4 ACCESSORY INSTALLATION

- A. General: 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-faced composite wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
- B. 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 excessive oil canning, 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 to result in 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 with no joints allowed within 24 inches 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 deep, filled with mastic sealant (concealed within joints).

3.5 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal-faced composite wall panel units within installed tolerance of 1/4 inch in 20 feet, nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Water-Spray Test: After completing the installation of 75-foot- by-2-story minimum area of metal-faced composite wall panel assembly, test assembly for water penetration according to AAMA 501.2 in a 2-bay area directed by Architect.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust completed metal-faced composite wall panel installation, including accessories.
- D. Metal-faced composite wall panels will be considered defective if they do not pass tests and inspections.
- E. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- F. Prepare test and inspection reports.

3.7 CLEANING

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

END OF SECTION 07 42 43

SECTION 07 42 65 - THERMAL AND AIR BARRIER SYSTEM

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. Provide a thermal and air barrier wall system for exterior cold-formed metal wall assemblies. Work includes:
 - 1. Exterior wall insulation panels and accessories.
- B. Related Sections:
 - 1. Division 05 Section "Cold-Formed Metal Framing": Load-bearing, metal exterior wall framing assemblies.

1.3 REFERENCES

- A. Reference standards:
 - 1. ASTM International (ASTM):
 - a. ASTM C203-99: Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation.
 - b. ASTM C209-98: Test Method for Cellulosic Fiber Insulating Board.
 - c. ASTM C518-04: Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - d. ASTM C1029-05: Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation.
 - e. ASTM C1289-06: Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
 - f. ASTM D1621-04a: Test Method for Compressive Properties of Rigid Cellular Plastics.
 - g. ASTM D1622-03: Test Method for Apparent Density of Rigid Cellular Plastics.
 - h. ASTM D2126-99: Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
 - i. ASTM E84-05: Test Method for Surface Burning Characteristics of Building Materials.
 - j. ASTM E96/E96M-05: Test Method for Water Vapor Transmission of Materials.
 - k. ASTM E331-00: Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference
 - l. ASTM E 2357-05: Test Method for Determining Air Leakage of Air Barrier

Assemblies.

2. Factory Mutual (FM):
 - a. FM 4880: Class I Wall and Ceiling Panels Building Corner Fire Test.
3. Underwriters Laboratories Inc. (UL):
 - a. UL 723: Surface Burning Characteristics of Building Materials.
4. National Fire Protection Association (NFPA):
 - a. NFPA 285-2006: Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus.

1.4 SYSTEM DESCRIPTION

- A. Furnish and install an exterior wall system that effectively controls thermal, air and water performance and provides continuity of the building envelope enclosure. The system shall include the following:
 1. Insulated sheathing secured to the exterior of the metal wall framing assembly.
 2. Joint, penetration, and gap sealing material for sealing component joints, penetrations through the wall system, and gaps between the building envelope enclosure, components, and wall opening frames.
- B. Performance Characteristics:
 1. Thermal performance:
 - a. Exterior insulation: ASTM C518, Stabilized R-value of 6.5 per inch of thickness with a minimum six month exposure capability to outdoor elements and 15 year thermal warranty.
 - b. Interior spray polyurethane foam: ASTM C518, 140degreeF/90day Aged R-Value (measured at 75degree F Mean Temp.), for product with a minimum 30 degree F ambient and substrate application temperature is R6.1/inch and 140degreeF/90day Aged R-Value (measured at 75degree F Mean Temp.), for product with a minimum 45 degree F ambient and substrate application temperature is R6.4/inch and 140 degreeF/90day Aged R-Value (measured at 75 degree F Mean Temp.), for product with a minimum 60 degree F ambient and substrate application temperature is R6.1/inch.
 - 1) Core density: ASTM D1622, Minimum 2.0 pcf.
 - 2) Acceptable adhesion to substrate based on specific minimum application temperature.
 2. Air barrier performance: When tested in accordance with ASTM E2357, at a test pressure of not less than 6.24 psf, air infiltration shall not exceed 0.04 cfm per square foot (0.2 L/s*m²) of fixed wall area. Testing should be conducted at positive and negative sustained wind loading of 12.5psf (600Pa) for one-hour duration in each direction, pressure cycling of the wall at 2000 cycles in both the

- positive and negative direction, ending with wind gust loading at 25psf.
3. Water penetration: When tested in accordance with ASTM E331, no uncontrolled water penetration shall occur at a minimum differential pressure of 6.24 psf for minimum test duration of 2hrs.
 4. Mold resistance: Thermal wall and air barrier system components shall provide non-food source for fungal growth.
- C. Code Compliance: Exterior wall system and component materials shall comply with the following requirements:
1. Exterior Insulation:
 - a. Class 1 (25 Flame Spread Index and < 450 Smoke Developed Index) classified at max. thickness per UL 723 criteria or ASTM E84 criteria.
 - b. Fire Performance Evaluation as a component of an NFPA 285 approved wall assembly per the requirements of the International Building Code.
 2. System complies with ASTM E2357-05: Test Method for determining Air Leakage of Air Barrier Assemblies.
 3. System complies with NFPA 285 06: Standard method of Testing for the Evaluation of Flammability Characteristics of Exterior Non-Load Bearing Wall Assemblies containing Combustible components using the Intermediate Scale, Multi-Story Test Apparatus.
- D. Fire Resistance:
1. System complies with NFPA 285 2006: Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus.
 2. Fire-stopping measures, per code, should be included at the floor line in the stud cavity when the wall assembly extends beyond the edge of the floor line.
- E. All joints, penetrations and gaps of the thermal and air barrier wall system shall be made watertight and air-tight.

1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions for each thermal wall and air barrier system component product required.
- C. Reports:
1. Submit Test Reports, summarized by Manufacturer of material(s), verifying qualities of thermal and air barrier wall system components meet or exceed specified requirements.
 - a. Include results of ASTM E2357 air barrier system testing and ASTM E331 water penetration tests.
 - b. Include mill certificates indicating steel framing sheet complies with the specified requirements.
 2. Submit Field Inspection and Test Reports in accordance with Field Quality Control requirements

- D. Samples: Submit following material samples.
 - 1. Insulation panel, 12" square.
 - 2. Insulation fasteners/washers and joint flashing tape, one each.
- E. Submit Material Safety Data Sheets (MSDS) for thermal and air barrier wall system components.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. The air barrier Installer shall be, during the award period as well as for the duration of the installation, officially recognized as a Certified Installer by the Thermal and Air Barrier Wall System Manufacturer (Certified Installer). The Certified Installer shall carry liability insurance and bonding.
 - 2. Each worker who is installing air barriers must be, or accompanied by, a Certified Installer.
 - 3. Each Certified Installer can supervise a maximum of five workers. The Certified Installer shall be thoroughly trained and experienced in the installation of air barriers of the types being applied. Certified Installers shall perform or directly supervise all air/vapor barrier work on the project.
 - 4. Certified Installers shall have their Thermal and Air Barrier Wall System Manufacturer Certification photo-identification cards in their possession and available on the project site, for inspection upon request.
- B. Pre-installation Meeting: Prior to commencement of application, review and document methods and procedures related to installation, including the following:
 - 1. Participants: Authorized representatives of the Contractor, Construction Manager, Owner, Architect, Applicator, and Manufacturer.
 - 2. Review metal wall framing assemblies for potential interference and conflicts and coordinate layout and support provisions for interfacing work.
 - 3. Review insulated sheathing methods and procedures related to application, including manufacturer's installation guidelines, Thermal and Air Barrier Wall System Manufacturer's Certification Program.
 - 4. Review construction schedule and confirm availability of products, applicator personnel, equipment and facilities.
 - 5. Review governing regulatory requirements, and requirements for insurance and certificates as applicable.
 - 6. Review field quality control procedures.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver Thermal and Air Barrier Wall System materials in Manufacturer's unopened containers or bundles, fully identified by name, brand, type and grade. Exercise care to avoid damage during unloading, storing and installation.
- B. Store, protect and handle Thermal and Air Barrier Wall System materials in accordance with the Manufacturer's recommendations to prevent damage, contamination and deterioration. Keep materials free of dirt and other foreign matter.

1.8 PROJECT CONDITIONS

- A. Environmental Requirements: Install Thermal and Air Barrier Wall System work only when weather conditions are in compliance with Manufacturer's specific environmental requirements and conditions will permit work to be performed in accordance with Manufacturer's recommendations and warranty requirements.

1.9 WARRANTY

- A. Submit the following warranties:
 - 1. Exterior insulation warranty: Six month exposure and 15 year thermal warranty.
 - 2. Flashing Tape: Limited Warranty.

PART 2 - PRODUCTS

2.1 EXTERIOR INSULATION

- A. Exterior Insulation: Glass-fiber-reinforced enhanced polyisocyanurate foam core sheathing faced with nominal 4 mil embossed white or blue acrylic-coated aluminum on one side and 1.25 mil embossed aluminum on the other side, complying with ASTM C1289 and meeting the following physical properties:
 - 1. ASTM C1289 Type 1, Class 2
 - 2. Compressive Strength (ASTM D1621): 25 psi, minimum.
 - 3. Aged Thermal Resistance (ASTM C518, measured at Mean Temp of 75F): R-6.5 at 1 inch RSI 1.06 per 25 mm of thickness with 15 year thermal warranty
 - 4. Flexural Strength (ASTM C203): Minimum 40 psi.
 - 5. Water Absorption (ASTM C209): Maximum.1.0 percent by volume.
 - 6. Water Vapor Permeance (ASTM E96): <0.3 perms.
 - 7. Maximum Use Temperature: 250 degrees F.
- B. Acceptable Products: The Dow Chemical Company "THERMAX™ ci Exterior Insulation" or comparable product.
 - 1. Panel Size: 4'-0" wide x 8'-0" long, square edge, shiplap (shiplap on thickness of 1.55" and greater) panels.
 - 2. Thickness and Stabilized R-Value: 2.5 inch thickness; minimum R-16.0.
- C. Accessories:
 - 1. Fasteners: Provide insulated sheathing manufacturer's recommended polymer or other corrosion-protective coated steel screw fasteners for anchoring sheathing to metal wall framing. Fastener length and size based on wall sheathing thickness.
 - a. Acceptable Products: Wind-lock Corporation "ci-Lock Steel Series Selection" with 1-3/4 inch diameter high-grade plastic washers.
 - 2. Insulation Flashing Tape: Provide insulation manufacturer's recommended board joint tape for sealing joints, seams and veneer tie penetrations through the

insulation layer.

- a. Acceptable Products: The Dow Chemical Company “WEATHERMATE™ Straight Flashing, or comparable product, 4-inch width with butyl rubber adhesive; 8-inch width at all girt attachments back to metal stud framing.
 - 1) Where exposed through open joints in wall cladding system, provide black color product acceptable for use by manufacturer of exterior insulation board.
3. Wall Opening Flashing: Provide insulated sheathing manufacturer's recommended flashing sealing window and door wall openings.
- a. Acceptable Products: The Dow Chemical Company “WEATHERMATE™ Straight Flashing, or comparable product, 6-inch and 9-inch, with butyl rubber adhesive, at straight opening heads, jambs and sills.
 - 1) Where exposed through open joints in wall cladding system, provide black color product acceptable for use by manufacturer of exterior insulation board.
 - b. When greater widths are required for through wall flashings butyl rubber adhesive is recommended.
4. Penetration Filler: Provide insulated sheathing manufacturer's recommended polyurethane foam for sealing penetrations of insulated sheathing.
- a. Acceptable Products: The Dow Chemical Company “Great Stuff™ Pro Gaps & Cracks” single-component polyurethane insulating foam sealant, or comparable product.
 - b. Acceptable Products: The Dow Chemical Company “Great Stuff™ Pro Window & Door” single-component polyurethane low-pressure foam sealant, or comparable product.
5. Gap Air Infiltration Filler: Two Component, Quick Cure Polyurethane Foam:
- a. Acceptable Products: The Dow Chemical Company FROTH-PAK™ Foam Insulation two component, quick-cure polyurethane foam, or comparable product.
 - 1) NFPA 286 Approval for Exposed use to the interior of the building without the need for a 15-min thermal barrier.
 - 2) ASTM E-84 Class A.
6. Flexible polyethylene foam gasketing strip to reduce air infiltration between a concrete foundation and sill plate.
- a. Acceptable Products: The Dow Chemical Company “WEATHERMATE™ SILL SEAL Foam Gasket, or comparable product.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and installation conditions for compliance with requirements for installation conditions affecting performance of the work.
 - 1. Verify that metal wall studs, opening framing, bridging, bracing and other framing support members and anchorage have been installed within thermal wall system alignment tolerances and requirements.
 - 2. Verify that substrate surfaces to receive spray polyurethane foam are free of frost, oil, grease, oxidation, dirt, loose paint, loose scale, or other deleterious material that would impair bond.
 - 3. Verify that items required to penetrate the thermal wall system are placed and penetration gaps and cracks are properly sealed before installation of spray polyurethane foam.
 - 4. Do not proceed with thermal and air barrier wall system installation until unsatisfactory conditions have been corrected.
- B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.2 INSULATION INSTALLATION

- A. Install insulation in accordance with manufacturer's recommendations. Fasten to exterior face of exterior metal stud wall framing using sheathing manufacturer's recommended type and length screw fasteners with washers. Abut panels tightly together and around openings and penetrations.
 - 1. Install sheathing panels horizontally with blue aluminum facing to exterior. Use maximum lengths to minimize number of joints. Locate edge joints parallel to and on framing. Center end joints over supports and stagger in each course. Provide additional framing wherever panel joints do not bear against framing, plates or sill members.
 - 2. Fasten panels to each support with fasteners spaced 12 inches on center at perimeter and 16 inches on center in panel field. Set back perimeter fasteners 3/8" from edges and ends of panel units. Drive fasteners to bear tight and flush with surface of insulation. Do not countersink. Perimeter fasteners can be detailed to bridge the gap of abutting board joints due to the 1.75" diameter of the washer used to fasten the board to the studs. Maximum of two board joints may be bridged per fastener.
 - 3. Install flashing joint tape at end and edge joints with sufficient hand pressure to ensure seal and in accordance with sheathing manufacturer's joint sealing recommendations.
 - 4. Install flashing tape behind wall tie and mechanical fastening assemblies for rain screen claddings.
 - 5. Seal sheathing joints and penetrations of sheathing in accordance with sheathing manufacturer's joint and penetration sealing recommendations.
 - 6. After base flashing, which may include a termination bar running horizontally along the top edge of the flashing, is installed on exterior of insulated sheathing, install WEATHERMATE™ Flashing 6-inch or 9-inch, with butyl rubber adhesive

to the exterior sheathing and lapped over the top edge of the base flashing.

END OF SECTION 07 42 65

SECTION 07 53 23 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

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. Adhered EPDM membrane roofing system.
2. Vapor retarder.
3. Roof insulation.

B. Related Sections:

1. Section 053100 "Steel Decking" for furnishing acoustical deck rib insulation.
2. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
3. Section 07 62 00 "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.
4. Section 07 92 00 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.3 DEFINITIONS

- A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.4 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
- C. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.
- D. FM Approvals Listing: Provide membrane roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470

as part of a membrane roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals' markings.

1. Fire/Windstorm Classification: Class 1A-60 .
 2. Hail Resistance: SH.
- E. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.
- F. Energy Performance: Provide roofing system that is listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low -slope roof products.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
1. Product Test Reports for Credit SS 7.2: For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirement.
 2. Product Data for Credit IEQ 4.1: For adhesives and sealants used inside the weatherproofing system, documentation including printed statement of VOC content.
 3. Laboratory Test Reports for Credit IEQ 4: For adhesives and sealants used inside the weatherproofing system, documentation indicating that they comply 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."
- C. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
1. Base flashings and membrane terminations.
 2. Tapered insulation, including slopes.
 3. Roof plan showing orientation of steel roof deck and orientation of membrane roofing and fastening spacings and patterns for mechanically fastened membrane roofing.
 4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For membrane roofing system to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is UL listed FM Approvals approved for membrane roofing system identical to that used for this Project.
- B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

- C. Source Limitations: Obtain components including roof insulation fasteners Insert products for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.
- D. Exterior Fire-Test Exposure: ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.
- E. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.9 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, cover boards, roofing accessories, roof pavers, and other components of membrane roofing system.
 - 2. Warranty Period: 20 years from date of Substantial Completion.

- B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering Work of this Section, including all components of membrane roofing system such as membrane roofing, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EPDM MEMBRANE ROOFING

- A. EPDM: ASTM D 4637, Type I, non-reinforced, uniform, flexible EPDM sheet.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlisle SynTec Incorporated.
 - b. Firestone Building Products.
 - c. Johns Manville.
 - d. Versico Incorporated.
 - 2. Thickness: 60 mils, nominal.
 - 3. Exposed Face Color: White on black.

2.2 AUXILIARY MEMBRANE ROOFING MATERIALS

- A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
 - 1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
 - 2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Single-Ply Roof Membrane Adhesives: 250 g/L.
 - f. Single-Ply Roof Membrane Sealants: 450 g/L.
 - g. Nonmembrane Roof Sealants: 300 g/L.
 - h. Sealant Primers for Nonporous Substrates: 250 g/L.
 - i. Sealant Primers for Porous Substrates: 775 g/L.
 - j. Other Adhesives and Sealants: 250 g/L.
- B. Sheet Flashing: 60-mil- thick EPDM, partially cured or cured, according to application.
- C. Bonding Adhesive: Manufacturer's standard, water based.

- D. Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 3-inch-wide minimum, butyl splice tape with release film.
- E. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.
- F. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
- G. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- H. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.
- I. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to roofing system manufacturer.
- J. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

2.3 SUBSTRATE BOARDS

- A. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch thick.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Georgia-Pacific Corporation; Dens Deck.

2.4 VAPOR RETARDER

- A. Polyethylene Film: ASTM D 4397, 10 mils thick, minimum, with maximum permeance rating of 0.039 perm.
 - 1. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
 - 2. Adhesive: Manufacturer's standard lap adhesive, FM Approvals approved for vapor-retarder application.

2.5 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by EPDM membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Approvals-approved roof insulation.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class I, Grade 3, 25 psi, felt or glass-fiber mat facer on both major surfaces.

- C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches unless otherwise indicated.
- D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.6 INSULATION ACCESSORIES

- A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
- C. Full-Spread Applied Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
- D. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch thick, factory primed.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Georgia-Pacific Corporation; Dens Deck Prime.

2.7 ROOF PAVERS

- A. Rubber Roof Pavers: Interlocking, lightweight rubber units, 24 by 24 by 2-1/4 inches, 6 lb/sq. ft. specially manufactured for use as roof ballast; with grooved back for four-way drainage, beveled and doweled; and as follows:
 - 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. Carlisle SynTec Incorporated; Interlocking Rubber Paver.
 - 2. Perimeter Securement Strip: Manufacturer's standard mill-finish aluminum sheet hold down and fasteners.
 - 3. Color: Gray.

2.8 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway rolls, approximately 3/16 inch thick, and acceptable to membrane roofing system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
 - 1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
 - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 05 31 00 "Steel Decking."
 - 4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
 - 5. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 6. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- D. Install acoustical roof deck rib insulation strips, specified in Section 053100 "Steel Decking," according to acoustical roof deck manufacturer's written instructions, immediately before installation of overlying construction and to remain dry.

3.3 SUBSTRATE BOARD

- A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
 - 1. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to membrane roofing system manufacturers' written instructions.

3.4 VAPOR-RETARDER INSTALLATION

- A. Polyethylene Film: Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches and 6 inches, respectively.
 - 1. Continuously seal side and end laps with tape or adhesive.
- B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into membrane roofing system.

3.5 INSULATION INSTALLATION

- A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
- E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
 - 1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
- G. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
 - 1. Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.6 ADHERED MEMBRANE ROOFING INSTALLATION

- A. Adhere membrane roofing over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll membrane roofing and allow to relax before installing.
- B. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.
- C. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

- D. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.
- E. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeters.
- F. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
- G. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement, and firmly roll side and end laps of overlapping membrane roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of membrane roofing terminations.
 - 1. Apply a continuous bead of in-seam sealant before closing splice if required by membrane roofing system manufacturer.
- H. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping membrane roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of membrane roofing terminations.
- I. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.
- J. Spread sealant or mastic bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.
- K. Adhere protection sheet over membrane roofing at locations indicated.

3.7 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.8 WALKWAY INSTALLATION

- A. Flexible Walkways: Install walkway products in locations indicated. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

- B. Roof-Paver Walkways: Install walkway roof pavers according to manufacturer's written instructions in locations indicated, to form walkways. Leave 3 inches of space between adjacent roof pavers.

3.9 FIELD QUALITY CONTROL

- A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
- B. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.
- C. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.10 PROTECTING AND CLEANING

- A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.11 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS **<Insert name>** of **<Insert address>**, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
 - 1. Owner: **<Insert name of Owner.>**
 - 2. Address: **<Insert address.>**
 - 3. Building Name/Type: **<Insert information.>**
 - 4. Address: **<Insert address.>**
 - 5. Area of Work: **<Insert information.>**
 - 6. Acceptance Date: **<Insert date.>**
 - 7. Warranty Period: **<Insert time.>**
 - 8. Expiration Date: **<Insert date.>**
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to

correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. Lightning;
 - b. Peak gust wind speed exceeding <Insert wind speed> mph;
 - c. Fire;
 - d. Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. Faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. Vapor condensation on bottom of roofing; and
 - g. Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this **<Insert day>** day of **<Insert month>**, **<Insert year>**.

1. Authorized Signature: **<Insert signature>**.
2. Name: **<Insert name>**.
3. Title: **<Insert title>**.

END OF SECTION 07 53 23

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

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. Formed Products:

- a. Formed roof drainage sheet metal fabrications.
 - b. Formed low-slope roof sheet metal fabrications.

- B. Related Sections:

- 1. Section 06 10 35 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Section 07 42 13 "Flatlock Metal Wall Panels" for sheet metal flashing and trim integral with flatlock metal wall panels.
 - 3. Section 07 42 43 "Composite Metal Wall Panels" for sheet metal flashing and trim integral with composite metal wall panels.
 - 4. Section 07 72 00 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
 - 5. Section 07 95 00 "Expansion Control" for manufactured sheet metal expansion-joint covers.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Fabricate and install roof edge flashing and copings capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:
 - 1. Wind Zone 1: For velocity pressures of 21 to 30 lbf/sq. ft.: 60-lbf/sq. ft. perimeter uplift force, 90-lbf/sq. ft. corner uplift force, and 30-lbf/sq. ft. outward force.
- C. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:
 1. Identification of material, thickness, weight, and finish for each item and location in Project.
 2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
 3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 4. Details of termination points and assemblies, including fixed points.
 5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction.
 6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
 7. Details of special conditions.
 8. Details of connections to adjoining work.
 9. Detail formed flashing and trim at a scale of not less than 1-1/2 inches per 12 inches.
- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
 1. Sheet Metal Flashing: Samples, 6 inches square, to show full range to be expected for each color required.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
- B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.8 WARRANTY

- A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows 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.

PART 2 - PRODUCTS

2.1 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
 - 1. Surface: Smooth, flat.
 - 2. Exposed Coil-Coated Finishes:
 - a. Two-Coat Fluoropolymer: AAMA 620. 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.
 - 3. Color: Match Architect's samples.
 - 4. Concealed Finish: Pretreat with 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.

- C. Zinc Sheet: Zinc, 99 percent pure, alloyed with a maximum of 1 percent copper and titanium; with manufacturer's standard factory-applied, flexible, protective back coating.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Basis-of-Design: Umicore Building Products USA Inc.; VM ZINC PLUS.
 - b. ATAS International, Inc.
 - c. Dri-Design, Inc.
 2. Finish:
 - a. Color 1: Provide where zinc material adjoins flatlock metal wall panel system - color 1 as specified in section 07 42 13 "Flatlock Metal Wall Panels". Match color 1 as listed in section 07 42 13.
 - b. Color 2: Provide where zinc material adjoins flatlock metal wall panel system - color 2 as specified in section 07 42 13 "Flatlock Metal Wall Panels", and composite wall panels as specified in section 07 42 43 "Composite wall panels". Match color 2 as listed in section 07 42 13.
 3. Source Limitations: To ensure color matching, use same manufacturer for zinc products specified in this section, section 07 42 13 "Flatlock Metal Wall Panels", and section 07 42 43 "Composite Wall Panels".

2.2 UNDERLAYMENT MATERIALS

- A. Polyethylene Sheet: 6-mil- thick polyethylene sheet complying with ASTM D 4397.
- B. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
- C. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 milsthick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F.
 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.
 3. Products: Subject to compliance with requirements, provide one of the following:
 - a. Carlisle Coatings & Waterproofing Inc.; CCW WIP 300HT.
 - b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
 - c. Henry Company; Blueskin PE200 HT.
 - d. Metal-Fab Manufacturing, LLC; MetShield.
 - e. Owens Corning; WeatherLock Metal High Temperature Underlayment.

2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete

sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 - 3. Fasteners for Zinc Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Series 300 stainless steel.
- C. 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 wide and 1/8 inch thick.
- D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- G. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
 - 1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 - 2. Obtain field measurements for accurate fit before shop fabrication.
 - 3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.
- D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" and by FMG Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.
- G. Do not use graphite pencils to mark metal surfaces.

2.5 ROOF DRAINAGE SHEET METAL FABRICATIONS

- A. Hanging Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch-long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters.
 1. Gutter Style: SMACNA designation A.
 2. Gutters with Girth up to 15 Inches: Fabricate from the following materials:
 - a. Zinc: 0.039 inch thick.
- B. Downspouts: Fabricate round downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
 1. Fabricate from the following materials:
 - a. Aluminum: 0.024 inch thick.
 - b. Zinc: 0.039 inch thick.
 2. Provide zinc at roof area 4. Provide aluminum at roof area 1.
- C. Parapet Scuppers: Fabricate scuppers of dimensions required with closure flange trim to exterior, 4-inch- wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fabricate from the following materials:
 1. Aluminum: 0.032 inch thick.

- D. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape indicated complete with outlet tubes, exterior flange trim, and built-in overflows. Fabricate from the following materials:
 - 1. Aluminum: 0.032 inch thick.
- E. Splash Pans: Fabricate from the following materials:
 - 1. Aluminum: 0.040 inch thick.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof-Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch- long, but not exceeding 10-foot- long, sections. Furnish with 6-inch- wide, joint cover plates.
 - 1. Joint Style: Butt, with 12-inch-wide, concealed backup plate.
 - 2. Fabricate from the following materials:
 - a. Aluminum: 0.050 inch thick.
 - b. Zinc: 0.048 inch thick.
- B. Copings: Fabricate in minimum 96-inch- long, but not exceeding 10-foot- long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight.
 - 1. Joint Style: Butt, with 12-inch- wide, concealed backup plate.
 - 2. Fabricate from the following materials:
 - a. Aluminum: 0.050 inch thick.
 - b. Zinc: 0.048 inch thick.
- C. Base Flashing: Fabricate from the following materials:
 - 1. Aluminum: 0.040 inch thick.
 - 2. Zinc: 0.032 inch thick.
- D. Counterflashing: Fabricate from the following materials:
 - 1. Aluminum: 0.032 inch thick.
 - 2. Zinc: 0.032 inch thick.
- E. Flashing Receivers: Fabricate from the following materials:
 - 1. Aluminum: 0.032 inch thick.
 - 2. Zinc: 0.032 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.
 - 1. Verify compliance with requirements for installation tolerances of substrates.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. Polyethylene Sheet: Install polyethylene sheet with adhesive for anchorage to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped and taped joints of not less than 2 inches.
- B. Felt Underlayment: Install felt underlayment with adhesive for temporary anchorage to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.
- C. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

3.3 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 3. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
 - 4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

5. Install sealant tape where indicated.
 6. Torch cutting of sheet metal flashing and trim is not permitted.
 7. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
1. Coat back side of uncoated aluminum sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of [10 feet] <Insert dimension> with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
- D. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
- E. Seal joints as shown and as required for watertight construction.
1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
 2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."
- F. Rivets: Rivet joints in uncoated aluminum where indicated and where necessary for strength.

3.4 ROOF DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.
- B. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored [gutter brackets] [straps] [twisted straps] spaced not more than 36 inches apart. Provide end closures and seal watertight with sealant. Slope to downspouts.
- C. Downspouts: Join sections with 1-1/2-inch telescoping joints.

1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c. in between.
 2. Provide elbows at base of downspout to direct water away from building.
 3. Connect downspouts to underground drainage system indicated.
- D. Splash Pans: Install where downspouts discharge on low-slope roofs. Set in elastomeric sealant compatible with roofing membrane.
- E. Parapet Scuppers: Install scuppers where indicated through parapet. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
1. Anchor scupper closure trim flange to exterior wall and seal with elastomeric sealant to scupper.
 2. Loosely lock front edge of scupper with conductor head.
 3. seal with elastomeric sealant exterior wall scupper flanges into back of conductor head.
- F. Conductor Heads: Anchor securely to wall with elevation of conductor head rim 1 inch below scupper discharge.

3.5 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at 16-inch centers.
- C. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 16-inch centers.
 2. Anchor interior leg of coping with screw fasteners and washers at 24-inch centers.
- D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
- E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with sealant. Secure in a waterproof manner by means of anchor and washer at 36-inch centers.

3.6 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.7 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean off excess sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 62 00

SECTION 07 72 00 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Roof hatches.
- B. Related Sections:
 - 1. Section 05 50 00 "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.
 - 2. Section 07 62 00 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.

1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For roof accessories. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
 - 1. Size and location of roof accessories specified in this Section.
 - 2. Method of attaching roof accessories to roof or building structure.
 - 3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
 - 4. Required clearances.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.7 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

PART 2 - PRODUCTS

2.1 METAL MATERIALS

- A. Aluminum Sheet: ASTM B 209, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
 - 1. Mill Finish: As manufactured.
 - 2. Concealed Finish: Pretreat with 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.
- B. Stainless-Steel Sheet and Shapes: ASTM A 240/A 240M or ASTM A 666, Type 304.

2.2 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, thickness as indicated.
- C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, [containing no arsenic or chromium,] and complying with AWPA C2; not less than 1-1/2 inchesthick.
- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- E. Underlayment:
 - 1. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
 - 2. Polyethylene Sheet: 6-mil- thick polyethylene sheet complying with ASTM D 4397.
 - 3. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.

- F. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 3. Fasteners for Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.
 4. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

2.3 ROOF HATCH

- A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, and integrally formed deck-mounting flange at perimeter bottom.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Bilco Company; Type NB-50T, or comparable product by one of the following:
 - a. Babcock-Davis.
 - b. J. L. Industries, Inc.
 - c. O'Keeffe's Inc.
- B. Type and Size: Single-leaf lid, 30 by 54 inches .
- C. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.
- D. Hatch Material: Aluminum sheet, 0.090 inch thick.
1. Finish: Mill .
- E. Construction:
1. Insulation: Polyisocyanurate board.
 2. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
 3. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
 4. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
 5. Fabricate curbs to minimum height of 12 inches unless otherwise indicated.
- F. Hardware: Stainless-steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.
1. Provide two-point latch on lids larger than 84 inches.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Verify dimensions of roof openings for roof accessories.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions.
 - 1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
 - 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
 - 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
 - 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of uncoated aluminum and stainless-steel roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
- C. Roof-Hatch Installation:
 - 1. Install roof hatch so top surface of hatch curb is level.
 - 2. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.

3.3 REPAIR AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780.
- B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."
- C. Clean exposed surfaces according to manufacturer's written instructions.
- D. Clean off excess sealants.
- E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 72 00

SECTION 07 81 00 - APPLIED FIREPROOFING

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. Sprayed fire-resistive materials (SFRM).
 - 2. Sprayed thermal barriers for plastics.
- B. Related Requirements:
 - 1. Division 05 sections for structural steel and metal fabrications receiving SFRM.
 - 2. Division 07 section "Fire Resistive Joint Systems".
 - 3. Section 078123 "Intumescent Mastic Fireproofing" for mastic and intumescent fire-resistive coatings.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review products, design ratings, restrained and unrestrained conditions, densities, thicknesses, bond strengths, and other performance requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. LEED Submittals:
 - 1. Product Data for Credit EQ 4.2: For paints and coatings, documentation including printed statement of VOC content.
 - 2. Laboratory Test Reports for Credit EQ 4: For paints and coatings used inside the weatherproofing system, documentation indicating that products comply 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."
- C. Shop Drawings: Framing plans, schedules, or both, indicating the following:
 - 1. Extent of fireproofing for each construction and fire-resistance rating.
 - 2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.

3. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
4. Treatment of fireproofing after application.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 50 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 72 hours before, during, and for 72 hours after product application.
- B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.
- B. Source Limitations: Obtain fireproofing from single source.
- C. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 1. Steel members are to be considered unrestrained unless specifically noted otherwise.
- D. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction and the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 1. Flat Paints and Coatings: 50 g/L.
 2. Nonflat Paints and Coatings: 150 g/L.
 3. Primers, Sealers, and Undercoaters: 200 g/L.
 4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
- E. Low-Emitting Materials: Fireproofing used within the weatherproofing system shall comply 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."

- F. Asbestos: Provide products containing no detectable asbestos.

2.2 SPRAYED FIRE-RESISTIVE MATERIALS

- A. SFRM, Medium Density: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application or conveyed in a dry state and mixed with atomized water at place of application.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Basis-of-Design: Grace, W.R. & Co. - Conn.; Grace Construction Products; Monokote MK-10 HB.
 - b. Isolatek International.
 - c. Carbolite Company, subsidiary of RPM International, Fireproofing Products Div..
 - d. Southwest Fireproofing Products Co..
2. Application: Designated for exterior use by a qualified testing agency acceptable to authorities having jurisdiction.
3. Bond Strength: Minimum 430-lbf/sq. ft. (20.59 kPa) cohesive and adhesive strength based on field testing according to ASTM E 736.
4. Density: Not less than 22 lb/cu. ft. (352 kg/cu. m) and as specified in the approved fire-resistance design, according to ASTM E 605.
5. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch.
6. Combustion Characteristics: ASTM E 136.
7. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 10 or less.
 - b. Smoke-Developed Index: 10 or less.
8. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
9. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
10. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
11. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours according to ASTM E 859.
12. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in rating of 10 according to ASTM D 3274 when tested according to ASTM D 3273.
13. Finish: Spray-textured finish.

- B. Thermal Barrier for Plastics: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application or conveyed in a dry state and mixed with atomized water at place of application.

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

- a. Isolatek International.
 - b. Carbolite Company, subsidiary of RPM International, Fireproofing Products Div..
 - c. Grace, W. R. & Co. - Conn.; Grace Construction Products.
 - d. Pyrok, Inc..
 - e. Schundler Company (The).
 - f. Southwest Fireproofing Products Co..
2. Bond Strength: Minimum 430 lbf/sq. ft. (20.59 kPa) cohesive and adhesive strength based on field testing according to ASTM E 736.
 3. Density: Not less than 22 lb/cu. ft. (352 kg/cu. m) as specified in the approved fire-resistance design, according to ASTM E 605.
 4. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker.
 5. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 6. Finish: Spray-textured finish.

2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
- B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with one or both of the following requirements:
 1. Primer and substrate are identical to those tested in required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 2. Primer's bond strength in required fire-resistance design complies with specified bond strength for fireproofing and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests according to ASTM E 736.
- C. Bonding Agent: Product approved by fireproofing manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.
- D. Sealer: Transparent-drying, water-dispersible, tinted protective coating recommended in writing by fireproofing manufacturer for each fire-resistance design.
 1. Locations for use:
 - a. All SFRM surfaces within mechanical rooms.
 - b. All SFRM surfaces exposed to view.
 - c. Acceptable for use as a primer for SFRM, where approved by

fireproofing manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design. Verify compliance with the following:
 - 1. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
 - 2. Objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
 - 3. Substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.
- B. Verify that concrete work on steel deck has been completed before beginning fireproofing work.
- C. Verify that roof construction, installation of roof-top HVAC equipment, and other related work is complete before beginning fireproofing work.
- D. Conduct tests according to fireproofing manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.
- E. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.
- B. Clean substrates of substances that could impair bond of fireproofing.
- C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.
- D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

- A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fireproofing work.
- B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.
- C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.
 - 1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
 - 2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.
- D. Metal Decks:
 - 1. Do not apply fireproofing to underside of metal deck substrates until concrete topping, if any, has been completed.
 - 2. Do not apply fireproofing to underside of metal roof deck until roofing has been completed; prohibit roof traffic during application and drying of fireproofing.
- E. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written recommendations for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.
- F. Spray apply fireproofing to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.
- G. Extend fireproofing in full thickness over entire area of each substrate to be protected.
- H. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.
- I. For applications over encapsulant materials, including lockdown (post-removal) encapsulants, apply fireproofing that differs in color from that of encapsulant over which it is applied.
- J. Where sealers are used, apply products that are tinted to differentiate them from fireproofing over which they are applied.
- K. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.
- L. Cure fireproofing according to fireproofing manufacturer's written recommendations.

- M. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.
- N. Finishes: Where indicated, apply fireproofing to produce the following finishes:
 - 1. Spray-Textured Finish: Finish left as spray applied with no further treatment.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
 - 1. Test and inspect as required by the IBC, 1704.10.
- B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.
- C. Fireproofing will be considered defective if it does not pass tests and inspections.
 - 1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
 - 2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.
- D. Prepare test and inspection reports.

3.5 CLEANING, PROTECTING, AND REPAIRING

- A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.
- B. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing will be without damage or deterioration at time of Substantial Completion.
- C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.
- D. Repair fireproofing damaged by other work before concealing it with other construction.
- E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 07 81 00

SECTION 07 81 23 - INTUMESCENT MASTIC FIREPROOFING

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 mastic and intumescent fire-resistive coatings (MIFRC).
- B. Related Requirements:
 - 1. Section 07 81 00 "Applied Fireproofing" for sprayed fire-resistive materials (SFRM).

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. LEED Submittals:
 - 1. Product Data for Credit EQ 4.2: For paints and coatings, documentation including printed statement of VOC content.
- C. Shop Drawings: Structural framing plans indicating the following:
 - 1. Extent of fireproofing for each construction and fire-resistance rating.
 - 2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
 - 3. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
 - 4. Treatment of fireproofing after application.
- D. Samples: For each exposed product and for each color and texture specified, 4 inches square in size.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects.
 - 1. Approval of mockups does not constitute approval of deviations from the

Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 50 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.
- B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.
- B. Source Limitations: Obtain fireproofing from single source.
- C. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 1. Steel members are to be considered unrestrained unless specifically noted otherwise.
- D. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction and the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 1. Flat Paints and Coatings: 50 g/L.
 2. Nonflat Paints and Coatings: 150 g/L.
 3. Primers, Sealers, and Undercoaters: 200 g/L.
 4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
 5. Fireproofing Exterior Coatings: 350 g/L.
- E. Asbestos: Provide products containing no detectable asbestos.

2.2 MASTIC AND INTUMESCENT FIRE-RESISTIVE COATINGS

- A. MIFRC : Manufacturer's standard, factory-mixed formulation or factory-mixed, multicomponent system consisting of intumescent base coat and topcoat, and complying with indicated fire-resistance design.

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. Albi Manufacturing, Division of StanChem Inc.; Albi Clad TF.
 - b. Carbolite Company, subsidiary of RPM International, Fireproofing Products Div.; Thermo-Sorb VOC.
 - c. Isolatak International; Cafco SprayFilm-WB 5.
2. Application: Designated for "conditioned interior space purpose" use by a qualified testing agency acceptable to authorities having jurisdiction.
3. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design.
4. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 50 or less.
5. Finish: Rolled, spray-textured finish.
 - a. Color and Gloss: Match Architect's sample.

2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
- B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Topcoat: Suitable for application over applied fireproofing; of type recommended in writing by fireproofing manufacturer for each fire-resistance design.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design. Verify compliance with the following:
 1. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
 2. Objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.

3. Substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.
- B. Conduct tests according to fireproofing manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.
- 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. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.
- B. Clean substrates of substances that could impair bond of fireproofing.
- C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.
- D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

- A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, topcoats, finishing, and other materials and procedures affecting fireproofing work.
- B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.
- C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.
 1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
 2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.
- D. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written recommendations for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.

- E. Spray apply fireproofing to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.
- F. Extend fireproofing in full thickness over entire area of each substrate to be protected.
- G. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.
- H. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.
- I. Cure fireproofing according to fireproofing manufacturer's written recommendations.
- J. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.
- K. Finishes: Where indicated, apply fireproofing to produce the following finishes:
 - 1. Rolled, Spray-Textured Finish: Even finish produced by rolling spray-applied finish with a damp paint roller to remove drippings and excessive roughness.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
 - 1. Test and inspect as required by the IBC, 1704.11.
- B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.
- C. Fireproofing will be considered defective if it does not pass tests and inspections.
 - 1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
 - 2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.
- D. Prepare test and inspection reports.

3.5 CLEANING, PROTECTING, AND REPAIRING

- A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

- B. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing will be without damage or deterioration at time of Substantial Completion.
- C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.
- D. Repair fireproofing damaged by other work before concealing it with other construction.
- E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 07 81 23

SECTION 07 84 46 - FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Joints in or between fire-resistance-rated constructions.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For fire-resistive joint system sealants, documentation including printed statement of VOC content.
- C. Product Schedule: For each fire-resistive joint system. Include location and design designation of qualified testing agency.
 - 1. Where Project conditions require modification to a qualified testing agency's illustration for a particular fire-resistive joint system condition, submit illustration, with modifications marked, approved by fire-resistive joint system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Installer Certificates: From Installer indicating fire-resistive joint systems have been installed in compliance with requirements and manufacturer's written recommendations.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fire-resistive joint systems.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

- B. Fire-Test-Response Characteristics: Fire-resistive joint systems shall comply with the following requirements:
 - 1. Fire-resistive joint system tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Fire-resistive joint systems are identical to those tested per testing standard referenced in "Fire-Resistive Joint Systems" Article. Provide rated systems complying with the following requirements:
 - a. Fire-resistive joint system products bear classification marking of qualified testing agency.
 - b. Fire-resistive joint systems correspond to those indicated by reference to designations listed by the following:
 - 1) UL in its "Fire Resistance Directory."
 - 2) Intertek ETL SEMKO in its "Directory of Listed Building Products."

1.6 PROJECT CONDITIONS

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

1.7 COORDINATION

- A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
- B. Coordinate sizing of joints to accommodate fire-resistive joint systems.
- C. Notify Owner's testing agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 FIRE-RESISTIVE JOINT SYSTEMS

- A. Where required, provide fire-resistive joint systems that are 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 assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

- B. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079:
 - 1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.
 - 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. Grace Construction Products.
 - b. Hilti, Inc.
 - c. Specified Technologies Inc.
 - d. 3M Fire Protection Products.
 - e. Tremco, Inc.; Tremco Fire Protection Systems Group.
- C. Exposed Fire-Resistive Joint Systems: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- D. VOC Content: Fire-resistive joint system sealants shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Architectural Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
- E. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
 - 1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
 - 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. 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 fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

3.3 INSTALLATION

- A. General: Install fire-resistive joint systems 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 position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.
- C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
 1. Fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
 2. Apply fill materials so they contact and adhere to substrates formed by joints.
 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Identify fire-resistive joint systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels will be visible to anyone seeking to remove or penetrate joint system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 1. The words "Warning - Fire-Resistive Joint System - Do Not Disturb. Notify Building Management of Any Damage."
 2. Contractor's name, address, and phone number.
 3. Designation of applicable testing agency.
 4. Date of installation.
 5. Manufacturer's name.
 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Where deficiencies are found or fire-resistive joint systems are damaged or removed due to testing, repair or replace fire-resistive joint systems so they comply with requirements.
- C. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTING

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

3.7 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHBN or Category XHDG.
- B. Head-of-Wall, Fire-Resistive Joint Systems:
 - 1. UL-Classified Systems: HW-D -0000-0999.
 - 2. Assembly Rating: As indicated on Drawings.
- C. Bottom-of-Wall, Fire-Resistive Joint Systems:
 - 1. UL-Classified Systems: BW-S-0000-0999.
 - 2. Assembly Rating: As indicated on Drawings.

END OF SECTION 07 84 46

SECTION 07 92 00 - 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 042000 "Unit Masonry" for masonry control and expansion joint fillers and gaskets.
2. Section 07 84 46 "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction.
3. Section 08 80 00 "Glazing" for glazing sealants.
4. Section 09 29 00 "Gypsum Board" for sealing perimeter joints.

1.3 PRECONSTRUCTION TESTING

- A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Submit not fewer than eight pieces of each kind of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

1.4 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For sealants and sealant primers used inside the weatherproofing system, documentation including printed statement of VOC content.
- C. 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.
- D. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

1.5 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.
 - 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 Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not

comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.
- C. 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. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1. Architectural Sealants: 250 g/L.
 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 3. Sealant Primers for Porous Substrates: 775 g/L.
- C. 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.
- D. 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.
- E. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- F. 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 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. BASF Building Systems; Omniseal 50.
 - b. Dow Corning Corporation; 795.
 - c. Sika Corporation, Construction Products Division; SikaSil-C995.
 - d. Tremco Incorporated; Spectrem 2.
- B. Mildew-Resistant, Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Pecora Corporation; 898.

2.3 URETHANE JOINT SEALANTS

- A. Single-Component, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type S, Grade P, Class 25, for Use T.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; Sonolastic SL 1.
 - b. Bostik, Inc.; Chem-Calk 950.
 - c. Pecora Corporation; Urexpan NR-201.
 - d. Sika Corporation. Construction Products Division; Sikaflex - 1CSL.
 - e. Tremco Incorporated; Vulkem 45.

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, provide one of the following:
 - a. BASF Building Systems; Sonolac.
 - b. Bostik, Inc.; Chem-Calk 600.
 - c. Pecora Corporation; AC-20+.
 - d. 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 horizontal traffic surfaces.
 - 1. Joint Locations:
 - a. Isolation and contraction joints in cast-in-place concrete slabs.
 - 2. Urethane Joint Sealant: Single component, pourable, traffic grade.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Construction joints in cast-in-place concrete.
 - b. Joints between plant-precast architectural concrete units.
 - c. Joints between metal panels.
 - d. Joints between different materials listed above.
 - e. Perimeter joints between materials listed above and frames of doors and windows.
 - f. Control and expansion joints in ceilings and other overhead surfaces.
 2. Silicone Joint Sealant: Single component, nonsag, neutral curing, Class 50 .
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
1. Joint Locations:
 - a. Isolation joints in cast-in-place concrete slabs.
 - b. Control and expansion joints in tile flooring.
 2. Urethane Joint Sealant: Single component, pourable, traffic grade.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior openings where indicated.
 - c. Tile control and expansion joints.
 - d. Vertical joints on exposed surfaces of interior unit masonry walls.
 - e. Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
 2. Joint Sealant: Latex.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- E. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Sealant Location:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints where indicated.

2. Joint Sealant: Mildew resistant, single component, nonsag, neutral curing, Silicone.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 07 92 00

SECTION 08 11 13 - 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 08 71 00 "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.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
- C. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.

3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 4. Locations of reinforcement and preparations for hardware.
 5. Details of each different wall opening condition.
 6. Details of 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.
- D. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.6 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- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

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. Ceco Door Products; an Assa Abloy Group company.
 2. Curries Company; an Assa Abloy Group company.
 3. LaForce, Inc.
 4. Premier Products, Inc.
 5. Steelcraft; an Ingersoll-Rand company.
- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed

and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

- B. Fire-Rated, Borrowed-Light Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.3 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. Provide at all locations unless otherwise noted.

- 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.

- c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.042 inch.

- d. Edge Construction: Model 1, Full Flush.

- 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: Uncoated steel sheet, minimum thickness of 0.053 inch.

- b. Construction: Full profile welded.

- 4. Exposed Finish: Prime.

- C. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3. Provide at Stairwells, Toilet Rooms, Storage Rooms, and Mechanical Rooms.

- 1. Physical Performance: Level A according to SDI A250.4.

- 2. Doors:

- a. Type: As indicated in the Door and Frame Schedule.

- b. Thickness: 1-3/4 inches.

- c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.053 inch.

- d. Edge Construction: Model 1, Full Flush.

- 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: Uncoated, steel sheet, minimum thickness of 0.053 inch.

- b. Construction: Full profile welded.
- 4. Exposed Finish: Prime.

2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Maximum-Duty Doors and Frames: SDI A250.8, Level 4. Provide at all locations.
 - 1. Physical Performance: Level A according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.067 inch, with minimum A40 coating.
 - 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 0.067 inch, with minimum A40 coating.
 - b. Construction: Full profile welded.
 - 4. Exposed Finish: Prime.

2.5 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 thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
 - 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
 - 3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
 - 4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:
 - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive

- fasteners.
2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.6 MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z 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, 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 08 80 00 "Glazing."
- J. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.7 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. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
 2. Fire Door Cores: As required to provide fire-protection ratings indicated.
 3. Vertical Edges for Single-Acting Doors: Provide beveled or square edges at manufacturer's discretion.
 4. Top Edge Closures: Close top edges of doors with inverted closures, except provide flush closures at exterior doors of same material as face sheets.
 5. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.
 6. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 7. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- 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. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 4. 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.
 5. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.

- 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - c. Compression Type: Not less than two anchors in each frame.
 - d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
- 6. Head Anchors: Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
- 7. 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.
- 8. Terminated Stops: Terminate stops 6 inches above finish floor with a 90-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.
- 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 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.

2.8 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.

2.9 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

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. At fire-rated openings, install frames according to NFPA 80.
 - b. 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.
- c. Install frames with removable stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. 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. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
 6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 7. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
 8. 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, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, 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 plus or minus 1/32 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
 - c. At Bottom of Door: 3/4 inch plus or minus 1/32 inch.
 - d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.
 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.

- D. Glazing: Comply with installation requirements in Section 08 80 00 "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 o.c. and not more than 2 inches 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. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 08 11 13

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Solid-core doors with wood-veneer faces.
 - 2. Factory finishing flush wood doors.
 - 3. Factory fitting flush wood doors to frames and factory machining for hardware.
- B. Related Sections:
 - 1. Section 08 80 00 "Glazing" for glass view panels in flush wood doors.
 - 2. Section 09 91 23 "Interior Painting" for field finishing doors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of door indicated. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.4: For adhesives and composite wood products, documentation indicating that product contains no urea formaldehyde.
- C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
 - 1. Indicate dimensions and locations of mortises and holes for hardware.
 - 2. Indicate dimensions and locations of cutouts.
 - 3. Indicate requirements for veneer matching.
 - 4. Indicate doors to be factory finished and finish requirements.
 - 5. Indicate fire-protection ratings for fire-rated doors.
- D. Samples for Initial Selection: For factory-finished doors.
- E. Samples for Verification:
 - 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.

2. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain flush wood doors from single manufacturer.
- B. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors."
- C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

1.7 WARRANTY

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

- a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. 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. Algoma Hardwoods, Inc.
 2. Eggers Industries.
 3. Graham; an Assa A bloy Group company.
 4. Marshfield Door Systems, Inc.

2.2 DOOR CONSTRUCTION, GENERAL

- A. Low-Emitting Materials: Fabricate doors with adhesives and composite wood products that do not contain urea formaldehyde.
- B. WDMA I.S.1-A Performance Grade:
 1. Heavy Duty unless otherwise indicated.
 2. Extra Heavy Duty: public toilets, janitor's closets, assembly spaces, and exits.
 3. Standard Duty: Closets (not including janitor's closets) .
- C. Particleboard-Core Doors:
- D. Structural-Composite-Lumber-Core Doors:
 1. Structural Composite Lumber: WDMA I.S.10.
 - a. Screw Withdrawal, Face: 700 lbf.
 - b. Screw Withdrawal, Edge: 400 lbf.
- E. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
 1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
 2. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.

F. Mineral-Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors :

1. Grade: Custom (Grade A faces).
2. Species: Select white maple .
3. Cut: Plain sliced (flat sliced).
4. Match between Veneer Leaves: Book match.
5. Assembly of Veneer Leaves on Door Faces: Running match.
6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
7. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 20 feet or more.
8. Exposed Vertical and Top Edges: Applied wood edges of same species as faces and covering edges of crossbands.
9. Core: Structural composite lumber.
10. Construction: Seven plies, either bonded or nonbonded construction.

2.4 LOUVERS AND LIGHT FRAMES

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads as follows unless otherwise indicated.

1. Wood Species: Same species as door faces.
2. Profile: Recessed tapered beads .
3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.

B. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with requirements in NFPA 80 for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. Openings: Cut and trim openings through doors in factory.
1. Light Openings: Trim openings with moldings of material and profile indicated.
 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00 "Glazing."

2.6 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.
- B. Finish doors at factory.
- C. Transparent Finish:
1. Grade: Custom.
 2. Finish: WDMA TR-6 catalyzed polyurethane.
 3. Staining: None required.
 4. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Section 08 71 00 "Door Hardware".

- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
 - 1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 - 1. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16

SECTION 08 31 13 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Access doors and frames for walls and ceilings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics according to the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- 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. Access Panel Solutions.
 - 2. Babcock-Davis.
 - 3. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
 - 4. Larsen's Manufacturing Company.
 - 5. Nystrom, Inc.
 - 6. .
- B. Source Limitations: Obtain each type of access door and frame from single source from

single manufacturer.

C. Flush Access Doors with Concealed Flanges:

1. Assembly Description: Fabricate door to fit flush to frame. Provide frame with gypsum board beads for concealed flange installation.
2. Locations: Gypsum board walls and ceilings as required.
3. Door Size: To be determined per location.
4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage.
 - a. Finish: Factory prime.
5. Frame Material: Same material and thickness as door.
6. Hinges: Manufacturer's standard.
7. Hardware: Lock.

D. Fire-Rated, Flush Access Doors with Exposed Flanges :

1. Assembly Description: Fabricate door to fit flush to frame, with a core of mineral-fiber insulation enclosed in sheet metal uninsulated. Provide self-latching door with automatic closer and interior latch release. Provide manufacturer's standard-width exposed flange, proportional to door size.
2. Locations: Masonry wall, in room Emergency Electrical Room 1108B.
3. Door Size: 24 inches wide by 72 inches height. Mount 16 inches above floor.
4. Fire-Resistance Rating: Not less than 1 hour.
5. Uncoated Steel Sheet for Door: Nominal 0.036 inch, 20 gage.
 - a. Finish: Factory prime.
6. Frame Material: Same material, thickness, and finish as door.
7. Hinges: Manufacturer's standard.
8. Hardware: Latch.

E. Hardware:

1. Latch: Self-latching bolt operated by ring turn with interior release.
2. Lock: Cylinder.

2.3 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- C. Frame Anchors: Same type as door face.
- D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.4 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.
 - 1. For concealed flanges with drywall bead, provide edge trim for gypsum board securely attached to perimeter of frames.
 - 2. Provide mounting holes in frames for attachment of units to metal or wood framing.
 - 3. Provide mounting holes in frame for attachment of masonry anchors.
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

2.5 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Steel and Metallic-Coated-Steel Finishes:
 - 1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08 31 13

SECTION 08 33 23 - OVERHEAD COILING 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. Insulated service doors.
- B. Related Sections:
 - 1. Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting" for finish painting of factory-primed doors.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design overhead coiling doors, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance, Exterior Doors: Exterior overhead coiling doors shall withstand the wind loads, the effects of gravity loads, and loads and stresses within limits and under conditions indicated according to SEI/ASCE 7.
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
- C. Operation Cycles: Provide overhead coiling door components and operators capable of operating for not less than number of cycles indicated for each door. 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.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type and size of overhead coiling door and accessory. Include the following:
 - 1. Construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
 - 2. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

3. For fire-rated doors, description of fire-release system including testing and resetting instructions.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.
1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 2. Show locations of replaceable fusible links.
 3. Wiring Diagrams: For power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

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

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
1. Obtain operators and controls from overhead coiling door manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

PART 2 - PRODUCTS

2.1 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, 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. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A 653/A 653M, with G90 (Z275) zinc coating; nominal sheet thickness (coated) of 0.028 inch and as required to meet requirements.

2. Vision-Panel Glazing: Manufacturer's standard clear glazing, fabricated from transparent acrylic sheet or fire-protection rated glass as required for type of door; set in glazing channel secured to curtain slats.
 3. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within slat faces.
 4. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.
- B. Endlocks and Windlocks for Service Doors: Malleable-iron casings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.
- C. Bottom Bar for Service Doors: Consisting of two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from manufacturer's standard hot-dip galvanized steel, stainless steel, or aluminum extrusions to match curtain slats and finish.
- D. 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 overtravel of curtain, and a continuous bar for holding windlocks.

2.2 HOOD

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
1. Galvanized Steel: Nominal 0.028-inch- thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A 653/A 653M.
 2. Exterior-Mounted Doors: Fabricate hood to act as weather protection and with a perimeter sealant-joint-bead profile for applying joint sealant.

2.3 LOCKING DEVICES

- A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
1. Lock Cylinders: Provide cylinders standard with manufacturer and keyed to building keying system.
 2. Keys: Provide three for each cylinder.
- B. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.4 CURTAIN ACCESSORIES

- A. Weatherseals: Equip each exterior door with weather-stripping gaskets fitted to entire perimeter of door for a weathertight installation, unless otherwise indicated.
 - 1. At door head, use 1/8-inch- thick, replaceable, continuous sheet secured to inside of hood.
 - 2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch- thick seals of flexible vinyl, rubber, or neoprene.
- B. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.
 - 1. Provide pull-down straps or pole hooks for doors more than 84 inches high.

2.5 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, welded or seamless 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. of span under full load.
- C. Spring Balance: 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.

2.6 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, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
 - 1. Comply with NFPA 70.
 - 2. Provide 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 Location(s): Operator location indicated for each door.

1. Top-of-Hood Mounted: Operator is mounted to the right or left door head plate with the operator on top of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Headroom is required for this type of mounting.
- D. Electric Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 11 05 13 "Common Motor Requirements for Equipment" unless otherwise indicated.
1. Electrical Characteristics:
 - a. Phase: Single phase.
 - b. Volts: 115 V.
 - c. Hertz: 60.
 2. Motor Type and Controller: Reversible motor and controller (disconnect switch) for motor exposure indicated.
 3. 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. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
 4. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 5. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
- E. Limit Switches: Equip each 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: Equip motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, 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. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.
- H. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.7 DOOR ASSEMBLY

- A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Cookson Company; Temp-Master Insulated Service Door, or comparable product by one of the following:
 - a. Cornell Iron Works, Inc.
 - b. McKeon Rolling Steel Door Company, Inc.
 - c. Wayne-Dalton Corp.
- B. Operation Cycles: Not less than 10,000.
 - 1. Include tamperproof cycle counter.
- C. STC Rating: Minimum 26.
- D. Curtain R-Value: R-8.
- E. Door Curtain Material: Galvanized steel.
- F. Hood: Match curtain material and finish.
 - 1. Shape: Round.
 - 2. Mounting: Between jambs.
- G. Locking Devices: Equip door with locking device assembly.
 - 1. Locking Device Assembly: Cremone type, both jamb sides locking bars, operable from inside and outside with cylinders.
- H. Electric Door Operator:
 - 1. Usage Classification: Medium duty, up to 15 cycles per hour.
 - 2. Operator Location: Top of hood.
 - 3. Motor Exposure: Exterior, wet, and humid.
 - 4. Emergency Manual Operation: Push-up type.
 - 5. Obstruction-Detection Device: Automatic photoelectric sensor.
 - 6. Remote-Control Station: Interior .
- I. Hood, Fascia, and Door Finish:
 - 1. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.
 - a. Provide different color for interior and exterior surfaces.

2.8 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" 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.

2.9 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 overhead coiling 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 overhead coiling doors, hoods, and operators at the mounting locations indicated for each door.
- C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

3.3 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Perform installation and startup checks according to manufacturer's written instructions.
 - 2. Test and adjust controls and safeties. 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 seals to provide weathertight fit around entire perimeter.

3.5 DEMONSTRATION

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

END OF SECTION 08 33 23

SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Exterior and interior storefront framing.
 - 2. Storefront framing for punched openings.
 - 3. Exterior and interior manual-swing entrance doors and door-frame units.

1.3 DEFINITIONS

- A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

1.4 PERFORMANCE REQUIREMENTS

- A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:
 - 1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
 - 2. Dimensional tolerances of building frame and other adjacent construction.
 - 3. Failure includes the following:
 - a. Deflection exceeding specified limits.
 - b. Thermal stresses transferring to building structure.
 - c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
 - d. Glazing-to-glazing contact.
 - e. Noise or vibration created by wind and by thermal and structural movements.
 - f. Loosening or weakening of fasteners, attachments, and other components.
 - g. Sealant failure.
 - h. Failure of operating units.
- B. Delegated Design: Design aluminum-framed systems, including comprehensive engineering analysis by a qualified professional engineer, using performance

requirements and design criteria indicated.

- C. Structural Loads:
 - 1. Wind Loads: As indicated on Drawings..
 - 2. Seismic Loads: As indicated on Drawings.

- D. Deflection of Framing Members:
 - 1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed $L/175$ of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to $3/4$ inch, whichever is less.
 - 2. Deflection Parallel to Glazing Plane: Limited to $L/360$ of clear span or $1/8$ inch, whichever is smaller.

- E. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:
 - 1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
 - 2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
 - 3. Test Durations: As required by design wind velocity, but not fewer than 10 seconds.

- F. Story Drift: Provide aluminum-framed systems that accommodate design displacement of adjacent stories indicated.
 - 1. Design Displacement: As indicated on Drawings.

- G. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft..

- H. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..

- I. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
 - 2. Interior Ambient-Air Temperature: 75 deg F.

- J. Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having an average U-factor of not more than 0.57 Btu/sq. ft. x h x deg F when tested according to AAMA 1503.

- K. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by aluminum-framed systems without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.
 - 1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
 - 2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.
- L. Structural-Sealant Joints: Designed to produce tensile or shear stress of less than 20 psi.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For adhesives and sealants used inside of the weatherproofing system, documentation including printed statement of VOC content.
- C. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.

1.6 INFORMATIONAL SUBMITTALS

- A. Preconstruction Test Reports: For sealant.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.
- C. Quality-Control Program for Structural-Sealant-Glazed System: Develop quality control program specifically for Project. Document quality-control procedures and verify results

for aluminum-framed systems. Comply with ASTM C 1401 recommendations including, but not limited to, system material-qualification procedures, preconstruction sealant-testing program, procedures for system fabrication and installation, and intervals of reviews and checks.

- D. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
 - 1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.
- E. Preconstruction Sealant Testing: For structural-sealant-glazed systems, perform sealant manufacturer's standard tests for compatibility with and adhesion of each material that will come in contact with sealants and each condition required by aluminum-framed systems.
 - 1. Test a minimum five samples each of metal, glazing, and other material.
 - 2. Prepare samples using techniques and primers required for installed systems.
 - 3. For materials that fail tests, determine corrective measures necessary to prepare each material to ensure compatibility with and adhesion of sealants including, but not limited to, specially formulated primers. After performing these corrective measures on the minimum number of samples required for each material, retest materials.
- F. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
- G. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.
- H. Structural-Sealant Glazing: Comply with ASTM C 1401, "Guide for Structural Sealant Glazing" for design and installation of structural-sealant-glazed systems.
- I. Structural-Sealant Joints: Design reviewed and approved by structural-sealant manufacturer.
- J. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration caused by thermal movements.
 - c. Deterioration of metals and other materials beyond normal weathering.
 - d. Adhesive or cohesive sealant failures.
 - e. Water leakage through fixed glazing and framing areas.
 - f. Failure of operating components.
 - 2. Warranty Period: Five years from date of Substantial Completion.
- B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.
 - 1. Warranty Period: 20 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.
 - 2. Kawneer North America; an Alcoa company.
 - 3. Pittco Architectural Metals, Inc.
 - 4. Tubelite.
 - 5. YKK AP America Inc.
- B. Design Parameters:
 - 1. Interior Systems:
 - a. Profile: 2-inch by 4-1/2 inch, center-glazed.
 - b. Finish: Clear Anodic Finish, Class I or thicker.

- c. Construction: Non-thermally broken.
2. Exterior Systems:
- a. Profile: 2-inch by 4-1/2 inch thermal system, outside-glazed.
 - b. Finish: Clear Anodic Finish, Class I or thicker.
 - c. Construction: Thermally broken.

2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
- 1. Sheet and Plate: ASTM B 209.
 - 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - 3. Extruded Structural Pipe and Tubes: ASTM B 429.
 - 4. Structural Profiles: ASTM B 308/B 308M.
 - 5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
- B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
- 1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 - 2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 - 3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

- A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
- 1. Construction: Nonthermal at Interior Systems; Thermally broken and Structurally glazed at Exterior Systems .
 - 2. Glazing System: Retained mechanically with gaskets on four sides; and Retained by structural sealant at vertical edges and mechanically with gaskets at horizontal edges; as shown on Drawings
 - 3. Glazing Plane: Front at Exterior Systems; Center at Interior Systems.
- B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
- 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.
- D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts, complying with ASTM A 123/A 123M or ASTM A 153/A 153M.

- E. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- F. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.
 - 1. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 GLAZING SYSTEMS

- A. Glazing: As specified in Section 08 80 00 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.
- C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.
- D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.
- E. Glazing Sealants: For structural-sealant-glazed systems, as recommended by manufacturer for joint type, and as follows:
 - 1. Structural Sealant: ASTM C 1184, single-component neutral-curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by a structural-sealant manufacturer for use in aluminum-framed systems indicated.
 - a. Sealants used inside the weatherproofing system shall have a VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use.
 - a. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Color: Matching structural sealant.

2.5 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.

1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 2. Door Design: Wide stile; 5-inch nominal width.
 - a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.
 3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.
- B. Entrance Door Hardware: As specified in Section 08 71 00 "Door Hardware."

2.6 ENTRANCE DOOR HARDWARE

- A. General: Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door to comply with requirements in this Section.
1. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
 2. Opening-Force Requirements:
 - a. Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbfto set the door in motion and not more than 15 lbf to open the door to its minimum required width.
 - b. Accessible Interior Doors: Not more than 5 lbf to fully open door.

2.7 ACCESSORY MATERIALS

- A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Section 07 92 00 "Joint Sealants."
1. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-milthickness per coat.

2.8 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

- C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
 - 4. Physical and thermal isolation of glazing from framing members.
 - 5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 6. Provisions for field replacement of glazing from exterior interior [interior for vision glass and exterior for spandrel glazing or metal panels].
 - 7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.
- F. Storefront Framing: Fabricate components for assembly using screw-spline system .
- G. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
 - 1. At exterior doors, provide compression weather stripping at fixed stops.
 - 2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.
- H. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
 - 1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
 - 2. At exterior doors, provide weather sweeps applied to door bottoms.
- I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

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 areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
6. Seal joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

- C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

- D. Set continuous sill members and flashing in full sealant bed as specified in Section 07 92 00 "Joint Sealants" to produce weathertight installation.

- E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

- F. Install glazing as specified in Section 08 80 00 "Glazing."

1. Structural-Sealant Glazing:

- a. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
- b. Install weatherseal sealant according to Section 07 92 00 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

- G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

- H. Install perimeter joint sealants as specified in Section 07 92 00 "Joint Sealants" to produce weathertight installation.

3.3 ERECTION TOLERANCES

- A. Install aluminum-framed systems to comply with the following maximum erection tolerances:
 - 1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length.
 - 2. Alignment:
 - a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.
- B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

3.4 FIELD QUALITY CONTROL

- A. Testing Services: Testing and inspecting of representative areas to determine compliance of installed systems with specified requirements shall take place as follows and in successive phases as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.
 - 1. Structural-Sealant Compatibility and Adhesion: Structural sealant shall be tested according to recommendations in ASTM C 1401.
 - a. Destructive Test Method A, "Hand Pull Tab (Destructive)," in ASTM C 1401, Appendix X2, shall be used.
 - 1) A minimum of four areas on each building face shall be tested.
 - 2) Repair installation areas damaged by testing.
 - 2. Structural-Sealant Glazing Inspection: After installation of aluminum-framed systems is complete, structural-sealant glazing shall be inspected and evaluated according to recommendations in ASTM C 1401.
 - 3. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified for laboratory testing under "Performance Requirements" Article, but not more than 0.09 cfm/sq. ft., of fixed wall area when tested according to ASTM E 783 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft..
 - 4. Water Spray Test: Before installation of interior finishes has begun, a minimum area of 75 feet by 1 story of aluminum-framed systems designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
- B. Repair or remove work if test results and inspections indicate that it does not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- D. Aluminum-framed assemblies will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.

1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch, measured to the leading door edge.

END OF SECTION 08 41 13

SECTION 08 45 13 - STRUCTURED-POLYCARBONATE-PANEL ASSEMBLIES

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-framed assemblies glazed with structured-polycarbonate panels as follows:
 - 1. Skylight assemblies.

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 for aluminum components of panel assemblies.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For sealants used inside the weatherproofing system, documentation including printed statement of VOC content.
- C. Shop Drawings: For panel assemblies. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Include details of provisions for assembly expansion and contraction and for draining moisture within the assembly to the exterior.
 - 2. Preconstruction Testing Shop Drawings: Prepared by a qualified preconstruction testing agency, showing details of laboratory mockup.
 - a. Resubmit Shop Drawings with changes made to details of laboratory mockup to successfully complete preconstruction testing.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For panel assemblies to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of panel assemblies required for this Project.
- B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

- C. Product Options: Information on Drawings and in Specifications establishes requirements for panel assemblies' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including testing conducted by an independent testing agency and in-service performance.
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- D. Preconstruction Testing: Provide panel assemblies that comply with test-performance requirements indicated, as evidenced by reports of tests performed on manufacturer's standard panel assemblies by a qualified independent testing agency.
 - 1. Preconstruction Testing Sequence: Test laboratory mockups according to AAMA 501, using the following sequence of tests:
 - a. Structural-performance preloading at one-half of the specified maximum test load (ASTM E 330).
 - b. Air infiltration (ASTM E 283).
 - c. Water penetration under static pressure (ASTM E 331).
 - d. Water penetration under dynamic pressure (AAMA 501.1).
 - e. Structural performance at design load (ASTM E 330).
 - f. Repeat air filtration (ASTM E 283).
 - g. Repeat water penetration under static pressure (ASTM E 331).
 - h. Structural performance at specified maximum test load (ASTM E 330).

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of panel assemblies 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. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - c. Water leakage.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Structured-Polycarbonate-Panel Warranty: Manufacturer's standard form in which manufacturer agrees to replace panels that exhibit defects in materials or workmanship..
 - 1. Defects include, but are not limited to, the following:
 - a. Delamination.
 - b. Color changes exceeding requirements.

- c. Losses in light transmission beyond 6 percent from original when measured per ASTM D 1003.
 - 2. Warranty Period: 10 years from date of Substantial Completion.
- C. Special Aluminum-Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
 - 1. Failures include, but are not limited to, checking, crazing, peeling, chalking, and fading of finishes.
 - 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide CPI Daylighting, Inc.; Quadwall Long-Span Skylights, or comparable product by one of the following:
 - 1. CO-EX Corp.
 - 2. Duo-Gard Industries Inc.
 - 3. EXTECH/Exterior Technologies Inc.
 - 4. Gallina USA, LLC.
 - 5. GSI Glazed Structures, Inc.
 - 6. Super Sky Products Inc.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Structured-polycarbonate-panel assemblies shall withstand the effects of the following forces without failure due to defective manufacture, fabrication, installation, or other defects in construction:
 - 1. Structural loads.
 - 2. Thermal movements.
 - 3. Movements of supporting structure.
 - 4. Dimensional tolerances of building frame and other adjacent construction.
 - 5. Failure includes, but is not limited to, the following:
 - a. Deflection exceeding specified limits.
 - b. Water leakage.
 - c. Thermal stresses transferred to building structure.
 - d. Noise or vibration created by wind, thermal, or structural movements.
 - e. Loosening or weakening of fasteners, attachments, and other components.
- B. Structural Loads:
 - 1. 2. Wind Loads: As indicated on Drawings.
- C. Deflection Limits:

1. Overhead Panel Assemblies: Limited to 1/100 of clear span for each assembly component.
- D. Structural-Test Performance: Provide panel assemblies tested according to ASTM E 330, as follows:
1. When tested at positive and negative wind-load design pressures, assemblies do not show evidence of deflection exceeding specified limits.
 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not show evidence of material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- E. Water Penetration under Dynamic Pressure: Provide panel assemblies that do not evidence water leakage through fixed glazing and framing areas when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..
1. Maximum Water Leakage: According to AAMA 501.1. Water leakage does not include water that is controlled by flashing and gutters and drained to the exterior, or water that cannot damage adjacent materials or finishes.
- F. Thermal Movements: Allow for thermal movements from ambient- and surface-temperature changes. 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, ambient; 180 deg F, material surfaces.
- G. Energy Performance: Provide panel assemblies with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below and certified and labeled according to NFRC:
1. Solar-Heat-Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.310 as determined according to NFRC 200.
 2. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.30 cfm/sq. ft. of fixed wall area as determined according to ASTM E 283 at a minimum static-air-pressure differential of 1.57 lbf/sq. ft..

2.3 ALUMINUM FRAMING SYSTEMS

- A. Components: Manufacturer's standard extruded-aluminum members of thickness required and reinforced as required to support imposed loads.
- B. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.
1. Sheet and Plate: ASTM B 209.
 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 3. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.

- 4. Structural Profiles: ASTM B 308/B 308M.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning skylight components.
- D. Fasteners and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding fasteners and accessories; compatible with adjacent materials.
 - 1. At closures, retaining caps, or battens, use ASTM A 193/A 193M, 300 series stainless-steel screws.
 - 2. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 3. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.
- E. Concealed Flashing: Corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- F. Exposed Flashing and Closures: Aluminum sheet not less than 0.050 inch thick, finished to match framing.
- G. Framing Gaskets: Manufacturer's standard gasket system with low-friction surface treatment designed specifically for retaining structured-polycarbonate panels.
- H. Framing Sealants: As recommended in writing by manufacturer.
 - 1. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- I. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.4 STRUCTURED-POLYCARBONATE PANELS

- A. Description: Translucent, extruded-polycarbonate sheet with cellular cross section that provides isolated airspaces and that is coextruded with a UV-protective layer.
 - 1. Plastic Self-Ignition Temperature: 650 deg F or more per ASTM D 1929.
 - 2. Smoke-Developed Index: 450 or less per ASTM E 84, or 75 or less per ASTM D 2843.
 - 3. Flame-Spread Index: Not more than 25 per ASTM E 84.
 - 4. Combustibility Classification: Class CC1 per ASTM D 635.
 - 5. Interior Finish Classification: Class A per ASTM E 84.
 - 6. Color Change: Not more than 3.0 units Delta E when measured according to ASTM D 2244 after outdoor weathering compliant with procedures in ASTM D 1435.
 - a. Outdoor Weathering Conditions: 60 months in Arizona or 120 months in a moderate North American climate.
- B. Panel Thickness: As required for span lengths, but no less than 8 mm per layer; total thickness of 4 inches.

- C. Panel Color: Ice White Matte for both interior and exterior panels.
 - 1. SHGC: 0.310.
 - 2. Light Transmittance: 36%.

2.5 FABRICATION

- A. Fabricate aluminum components before finishing.
- B. Fabricate aluminum components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Internal guttering systems or other means to drain water passing through joints, condensation occurring within components, and moisture migrating within assembly to exterior.
- C. Fabricate aluminum sill closures with weep holes and for installation as continuous component.
- D. Reinforce aluminum components as required to receive fastener threads.

2.6 ALUMINUM FINISHES

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's written instructions.
 - 2. Do not install damaged components.
 - 3. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
 - 4. Rigidly secure nonmovement joints.
 - 5. Install anchors with separators and isolators to prevent metal corrosion, electrolytic deterioration, and immobilization of moving joints.
 - 6. Seal joints watertight unless otherwise indicated.

- B. Metal Protection: Where aluminum components will contact dissimilar materials, protect against galvanic action by painting contact surfaces with corrosion-resistant coating or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.
- C. Install continuous aluminum sill closures with weatherproof expansion joints and locked and sealed corners. Locate weep holes at rafters.
- D. Install components to drain water passing through joints, condensation occurring within aluminum members, and moisture migrating within assembly to exterior.
- E. Install components plumb and true in alignment with established lines and elevations.
- F. Erection Tolerances: Install panel assemblies to comply with the following maximum tolerances:
 - 1. Alignment: Limit offset from true alignment to 1/32 inch where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches; otherwise, limit offset to 1/8 inch.
 - 2. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet, but no greater than 1/2 inch over total length.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
 - 1. Water-Spray Test: Before installation of interior finishes has begun, panel assemblies shall be tested according to AAMA 501.2 and shall not show evidence of water penetration.
- B. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- D. Prepare test and inspection reports.

END OF SECTION 08 45 13

SECTION 08 56 19 - PASS-THRU 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:

- 1. Flush-mount pass-thru windows.

- B. Related Sections:

- 1. Section 07 62 00 – Sheet Metal Flashing and Trim.
- 2. Section 07 92 00 – Joint Sealants.

1.3 REFERENCES

- A. Reference Standards:

- 1. ASTM A 240 – Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels.
- 2. ASTM A 653 – Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- 3. ASTM B 209 – Aluminum and Aluminum-Alloy Sheet and Plate.
- 4. ASTM B 221 – Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- 5. ASTM C 1048 – Heat-Treated Flat Glass--Kind HS, Kind FT Coated and Uncoated Glass.

1.4 SUBMITTALS

- A. Comply with Section 01330 (01 33 00) – Submittal Procedures.
- B. Product Data: Submit manufacturer's product data, including materials, components, fabrication, finish, and installation instructions.
- C. Shop Drawings: Submit manufacturer's shop drawings, including plans, elevations, sections, and details, indicating dimensions, tolerances, materials, fabrication, glazing, fasteners, hardware, finish, electrical wiring diagrams, options, and accessories.

- D. Samples: Submit manufacturer's samples of standard finishes.
- F. Operation and Maintenance Manual: Submit manufacturer's operation and maintenance manual, including operation, maintenance, adjustment, and cleaning instructions, trouble shooting guide, parts list, and electrical wiring diagrams.
- G. Warranty: Submit manufacturer's standard warranty.

1.5 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Minimum of 25 years successful experience continuously manufacturing pass-thru windows.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.
- C. Handling: Protect materials and finish from damage during handling and installation.

PART 2 - PRODUCTS

2.1 FLUSH-MOUNT PASS-THRU WINDOWS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Ready Access Inc.; Model 550 Window, or comparable product.
 - 1. Unit Size: Overall size of 84 inches wide by 54 inches high.
 - 2. Service Opening: 19 inches wide each .
 - 3. Door Operation:
 - a. Open: Manual.
 - b. Close: Manual or self-closing.
 - 4. Door Type: Sliding, 1 door panel at each end (2 doors total).
 - 5. Opening Direction: Right to left and Left to right. Customer View – Outside.
 - 6. Frame: Extruded aluminum, ASTM B 221, Alloy 6063-T6 and 6063-T52.
 - 7. Aluminum Sheet: ASTM B 209, Alloy 5005-AQ-H34.
 - 8. Galvanized Steel Sheet: ASTM A 653, G90.
 - 9. Bottom Sill: Angled downward, track-free.
 - 10. Security: Automatically locks each time door closes.
 - 11. Security Lock: Thumbturn lock, and night security lock bar.
 - 12. Fasteners: Stainless steel rivets and hex-head zinc-plated self-threading machine screws.
 - 13. Handle: Black Delrin handle with pressed-in stainless steel spring pins. Stainless steel handle mounting bracket. Stainless steel spring-loaded mounting base.

14. Glazing: Minimum 1/4-inch tempered glass, ASTM C 1048, clear.

2.2 BUMP-OUT PASS-THRU WINDOWS

A. See individual model for guide specifications.

2.3 FABRICATION

A. Assembly: Factory assembled, factory glazed.

2.4 ALUMINUM FINISH

A. Powder Coat Painted:

1. Paint: Tiger Drylac Series 49.
2. System: Heated phosphate-cleaned, electrostatic powder-coated, infrared oven-cured.
3. Color: Custom color to match architects sample. Intent is to match color of flatlock metal panel - color 2, as specified in Section 07 42 13 "Flatlock Metal Wall Panels."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive pass-thru windows. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Ensure openings to receive pass-thru windows are plumb, level, square, accurately aligned, correctly located, and in tolerance.

3.3 INSTALLATION

- A. Install pass-thru windows in accordance with manufacturer's instructions.
- B. Install pass-thru windows plumb, level, square, true to line, and without warp or rack.
- C. Install pass-thru window components weathertight.
- D. Anchor pass-thru windows securely in place to supports. Use attachment methods permitting adjustment for construction tolerances, irregularities, alignment, and expansion and contraction.
- E. Separate aluminum from other metal surfaces with bituminous coatings or other means

approved by Architect.

- F. Sheet Metal Flashing: Install sheet metal flashing as specified in Section 07 62 00.
- G. Joint Sealants: Install joint sealants as specified in Section 07 92 00.
- H. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
- I. Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.4 ADJUSTING

- A. Adjust doors to be weathertight in closed position.
- B. Adjust doors and operating hardware to function properly and for smooth operation without binding.

3.5 CLEANING

- A. Clean pass-thru windows promptly after installation in accordance with manufacturer's instructions.
- B. Remove excess joint sealant in accordance with sealant manufacturer's instructions.
- C. Do not use harsh cleaning materials or methods that would damage glazing or finish.

3.6 PROTECTION

- A. Protect installed pass-thru windows to ensure that, except for normal weathering, pass-thru windows will be without damage or deterioration at time of substantial completion.

END OF SECTION 08 56 19

SECTION 08 71 00 – 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 and electrified door hardware for:
 - a. Swinging doors.
 - 2. Electronic access control system components, including:
 - a. Electronic access control locksets and exit device trim.
 - 3. Field verification, preparation and modification of existing doors and frames to receive new door hardware.
- B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:
 - 1. Windows
 - 2. Cabinets (casework), including locks in cabinets
 - 3. Signage
 - 4. Toilet accessories
 - 5. Overhead doors
- C. Related Sections:
 - 1. Division 01 Section "Alternates" for alternates affecting this section.
 - 2. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
 - 3. Division 09 sections for touchup finishing or refinishing of existing openings modified by this section.
 - 4. Division 26 sections for connections to electrical power system and for low-voltage wiring.
 - 5. Division 28 sections for coordination with other components of electronic access control system.

1.3 REFERENCES

- A. Fire/Life Safety
 - 1. NFPA - National Fire Protection Association
 - a. NFPA 70 – National Electric Code

- b. NFPA 80 - Standard for Fire Doors and Fire Windows
 - c. NFPA 101 - Life Safety Code
 - d. NFPA 105 - Smoke and Draft Control Door Assemblies
- 2. State Fire Safety Code.
- B. UL - Underwriters Laboratories
 - 1. UL 10B - Fire Test of Door Assemblies
 - 2. UL 10C - Positive Pressure Test of Fire Door Assemblies
 - 3. UL 1784 - Air Leakage Tests of Door Assemblies
 - 4. UL 305 - Panic Hardware
- C. Accessibility
 - 1. ADA - Americans with Disabilities Act.
 - 2. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
- D. DHI - Door and Hardware Institute
 - 1. Sequence and Format for the Hardware Schedule
 - 2. Recommended Locations for Builders Hardware
 - 3. Key Systems and Nomenclature
- E. ANSI - American National Standards Institute
 - 1. ANSI/BHMA A156.1 - A156.29, and ANSI A156.31 - Standards for Hardware and Specialties

1.4 SUBMITTALS

- A. General:
 - 1. Submit in accordance with Conditions of Contract and Division 01 requirements.
 - 2. Highlight, encircle, or otherwise specifically identify on submittals deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.
 - 3. Prior to forwarding submittal, comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, "EXAMINATION" article, herein.
- B. Action Submittals:
 - 1. Product Data: Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
 - 2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
 - a. Wiring Diagrams: For power, signal, and control wiring and including:
 - 1) Details of interface of electrified door hardware and building safety and security systems.
 - 2) Schematic diagram of systems that interface with electrified door hardware.
 - 3) Point-to-point wiring.

- 4) Risers.
3. Samples for Verification: If requested by Architect, submit production sample or sample installations of each type of exposed hardware unit in finish indicated, and tagged with full description for coordination with schedule.
 - a. Samples will be returned to supplier in like-new condition. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
 4. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:
 - a. Door Index; include door number, heading number, and Architects hardware set number.
 - b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
 - c. Type, style, function, size, and finish of each hardware item.
 - d. Name and manufacturer of each item.
 - e. Fastenings and other pertinent information.
 - f. Location of each hardware set cross-referenced to indications on Drawings.
 - g. Explanation of all abbreviations, symbols, and codes contained in schedule.
 - h. Mounting locations for hardware.
 - i. Door and frame sizes and materials.
 - j. Name and phone number for local manufacturer's representative for each product.
 - k. Operational Description of openings with any electrified hardware (locks, exits, electromagnetic locks, electric strikes, automatic operators, door position switches, magnetic holders or closer/holder units, and access control components). Operational description should include how door will operate on egress, ingress, and fire and smoke alarm connection.
 - 1) 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 fabrication of other work that is critical in Project construction schedule.
 5. Key Schedule:
 - a. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.
 - b. Use ANSI A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
 - c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
 - d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.

- e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
 - 1) Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
 - f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.
6. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory prepared for door hardware installation.
- C. Informational Submittals:
- 1. Qualification Data: For Supplier, Installer and Architectural Hardware Consultant.
 - 2. Product Certificates for electrified door hardware, signed by manufacturer:
 - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
 - 3. Certificates of Compliance:
 - a. Certificates of compliance for fire-rated hardware and installation instructions if requested by Architect or Authority Having Jurisdiction.
 - b. Installer Training Meeting Certification: Letter of compliance, signed by Contractor, attesting to completion of installer training meeting specified in "QUALITY ASSURANCE" article, herein.
 - c. Electrified Hardware Coordination Conference Certification: Letter of compliance, signed by Contractor, attesting to completion of electrified hardware coordination conference, specified in "QUALITY ASSURANCE" article, herein.
 - 4. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by qualified testing agency, for door hardware on doors located in accessible routes.
 - 5. Warranty: Special warranty specified in this Section.
- D. Closeout Submittals:
- 1. Operations and Maintenance Data : Provide in accordance with Division 01 and include:
 - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Name, address, and phone number of local representative for each manufacturer.
 - d. Parts list for each product.
 - e. Final approved hardware schedule, edited to reflect conditions as-installed.
 - f. Final keying schedule
 - g. Copies of floor plans with keying nomenclature
 - h. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
 - i. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.5 QUALITY ASSURANCE

- A. Product Substitutions: Comply with product requirements stated in Division 01 and as specified herein.
1. Where specific manufacturer's product is named and accompanied by "No Substitute," including make or model number or other designation, provide product specified. (Note: Certain products have been selected for their unique characteristics and particular project suitability.)
 - a. Where no additional products or manufacturers are listed in product category, requirements for "No Substitute" govern product selection.
 2. Where products indicate "acceptable substitute" or "acceptable manufacturer", provide product from specified manufacturers, subject to compliance with specified requirements and "Single Source Responsibility" requirements stated herein.
- B. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural Hardware Consultant (AHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
1. Warehousing Facilities: In Project's vicinity.
 2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
 3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
 4. Coordination Responsibility: Coordinate installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.
 - a. Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.
- C. Installer Qualifications: Qualified tradesmen, skilled in application of commercial grade hardware with record of successful in-service performance for installing door hardware similar in quantity, type, and quality to that indicated for this Project.
- D. Architectural Hardware Consultant Qualifications: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
1. For door hardware, DHI-certified, Architectural Hardware Consultant (AHC).
 2. Can provide installation and technical data to Architect and other related subcontractors.
 3. Can inspect and verify components are in working order upon completion of installation.
 4. Capable of producing wiring diagrams.
 5. Capable of coordinating installation of electrified hardware with Architect and electrical engineers.
- E. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated.
- F. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
- G. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.
- H. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.
- I. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release latch. Locks do not require use of key, tool, or special knowledge for operation.
- J. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in "REFERENCES" article, herein.
1. Provide operating devices that do not require tight grasping, pinching, or twisting of wrist and that operate with force of not more than 5 lbf (22.2 N).
 2. Maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
 - b. Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
 - c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 3. Bevel raised thresholds with 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 open position of 70 degrees, door will take at least 3 seconds to move to 3 inches (75 mm) from latch, measured to leading edge of door.
- K. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01.
1. Attendees: Owner, Contractor, Architect, Installer, Owner's security consultant, and Supplier's Architectural Hardware Consultant.
 2. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
 - a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - b. Preliminary key system schematic diagram.
 - c. Requirements for key control system.
 - d. Requirements for access control.
 - e. Address for delivery of keys.

- L. Pre-installation Conference: Conduct conference at Project site.
 - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Inspect and discuss preparatory work performed by other trades.
 - 3. Inspect and discuss electrical roughing-in for electrified door hardware.
 - 4. Review sequence of operation for each type of electrified door hardware.
 - 5. Review required testing, inspecting, and certifying procedures.

- M. Coordination Conferences:
 - 1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.
 - a. Attendees: Door hardware supplier, door hardware installer, Contractor.
 - b. After meeting, provide letter of compliance to Architect, indicating when meeting was held and who was in attendance.

 - 2. Electrified Hardware Coordination Conference: Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.
 - a. Attendees: electrified door hardware supplier, doors and frames supplier, electrified door hardware installer, electrical subcontractor, Owner, Owner's security consultant, Architect and Contractor.
 - b. After meeting, provide letter of compliance to Architect, indicating when coordination conference was held and who was in attendance.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.

- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
 - 1. Deliver each article of hardware in manufacturer's original packaging.

- C. Project Conditions:
 - 1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
 - 2. Provide secure lock-up for door hardware delivered to Project, but not yet installed. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

- D. Protection and Damage:
 - 1. Promptly replace products damaged during shipping.
 - 2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
 - 3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

- E. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.
- F. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.7 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- 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. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
- E. 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.
- F. Direct shipments not permitted, unless approved by Contractor.

1.8 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. Warranty Period: Years from date of Substantial Completion, for durations indicated.
 - a. Closers:
 - 1) Mechanical: 30 years.
 - 2) Electrified: 2 years.
 - b. Exit Devices:
 - 1) Mechanical: 3 years.
 - 2) Electrified: 1 year.
 - c. Locksets:
 - 1) Mechanical: 3 years.
 - 2) Electrified: 1 year.
 - d. Continuous Hinges: Lifetime warranty.
 - e. Key Blanks: Lifetime

2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

1.9 MAINTENANCE

A. Extra Materials:

1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Maintenance Tools:

1. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The Owner requires use of certain products for their unique characteristics and particular project suitability to insure continuity of existing and future performance and maintenance standards. After investigating available product offerings Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: "No Substitute."

1. Where "No Substitute" is noted, submittals and substitution requests for other products will not be considered.

- B. Approval of products from manufacturers indicated as "Acceptable Manufacturer" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.

- C. Hand of Door: Drawings show direction of slide, swing, or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.

- D. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.2 EXISTING MATERIALS

- A. Where existing door hardware is indicated to be removed and reinstalled:

1. Carefully remove door hardware and components.
2. Clean, protect and store existing door hardware in accordance with storage and handling requirements specified herein.
3. Reinstall in accordance with installation requirements for new door hardware.

2.3 MATERIALS

- A. Fasteners

1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
 2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
 3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
 4. Install hardware with fasteners provided by hardware manufacturer.
- B. Modification and Preparation of Existing Doors: Provide necessary fillers, Dutchmen, reinforcements, and fasteners, compatible with existing materials, as required for mounting new opening hardware and to cover existing door and frame preparations.
1. Use materials which match materials of adjacent modified areas.
 2. When modifying existing fire-rated openings, provide materials permitted by NFPA 80 as required to maintain fire-rating.
- C. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

2.4 HINGES

- A. Provide five-knuckle, ball bearing hinges.
1. Manufacturers and Products:
 - a. Scheduled Manufacturer and Product: Ives 5BB series.
 - b. Acceptable Manufacturers: Hager BB series, Stanley FBB series.
- B. Requirements:
1. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
 - a. Exterior: Heavy weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
 - b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high
 2. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
 - a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
 3. 2 inches or thicker doors:
 - a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high

4. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
5. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
6. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - a. Steel Hinges: Steel pins
 - b. Non-Ferrous Hinges: Stainless steel pins
 - c. Out-Swinging Exterior Doors: Non-removable pins
 - d. Out-Swinging Interior Lockable Doors: Non-removable pins
 - e. Interior Non-lockable Doors: Non-rising pins
7. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.
8. Doors 36 inches (914 mm) wide or less furnish hinges 4 1/2 inches (114 mm) high; doors greater than 36 inches (914 mm) wide furnish hinges 5 inches (127 mm) high, heavy weight or standard weight as specified.
9. Provide mortar guard for each electrified hinge specified, unless specified in hollow metal frame specification.

2.5 ELECTRIC POWER TRANSFER

- A. Manufacturers:
 - a. Scheduled Manufacturer: Von Duprin
 - b. Acceptable Manufacturers: No Substitute
- B. Provide power transfer with number and gage of wires sufficient to accommodate electric function of specified hardware.
- C. Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

2.6 FLUSH BOLTS

- A. Manufacturers:
 1. Scheduled Manufacturer: Ives
 2. Acceptable Manufacturers: Hiawatha, Trimco
- B. Requirements:
 1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

2.7 COORDINATORS

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Hiawatha, Trimco

B. Requirements:

1. Where pairs of doors are equipped with automatic flush bolts, an astragal, or other hardware that requires synchronized closing of the doors, provide bar-type coordinating device, surface applied to underside of stop at frame head.
2. Provide filler bar of correct length for unit to span entire width of opening, and appropriate brackets for parallel arm door closers and surface vertical rod exit device strikes. Factory-prep coordinators for vertical rod devices if required.

2.8 CYLINDRICAL LOCKS – GRADE 1

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage ND Series
2. Acceptable Manufacturers: No Substitute.

B. Requirements:

1. Provide cylindrical locks conforming to ANSI A156.2 Series 4000, Grade 1. Cylinders: Refer to “KEYING” article, herein.
2. Provide locksets able to withstand 1500 inch pounds of torque applied to locked outside lever without gaining access per ANSI A156.2 Abusive Locked Lever Torque Test and cycle tested to 3 million cycles per ANSI A156.2 Cycle Test.
3. Provide levers with vandal resistant technology for use at heavy traffic or abusive applications. Levers feature internal lock components that prevent damage caused by excessive force from persons kicking, hitting or standing on lever to gain access.
4. Provide solid steel rotational stops to control excessive rotation of lever.
5. Provide completely refunctionable lockset that allows lock function to be changed to over twenty other common functions by swapping easily accessible parts.
6. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2 inch latch throw. Provide proper latch throw for UL listing at pairs.
7. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
8. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
9. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
10. Provide electrical options as scheduled.
11. Lever Trim: Solid cast levers without plastic inserts, and wrought roses on both sides.
 - a. Lever Design: Schlage Rhodes.
 - b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

2.9 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Von Duprin 99 Series
2. Acceptable Manufacturers: No Substitution.

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1, and UL listed for Panic Exit or Fire Exit Hardware. Cylinders: Refer to "KEYING" article, herein.
2. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
3. Quiet Operation: Incorporate fluid damper or other device that eliminates noise of exit device operation.
4. Touchpad: Extend minimum of one half of door width, but not the full length of exit device rail. Provide end-cap with two-point attachment to door. Match exit device finish, stainless steel for US26, US26D, US28, US32, and US32D finishes; and for all other finishes, provide compatible finish to exit device. Provide compression springs in devices, latches, and outside trims or controls; tension springs prohibited.
5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrical requirements.
6. Concealed Vertical Cable Exit Devices: Cable-actuated concealed vertical latch system in two-point and less bottom latch (LBL) configurations. Vertical rods not permitted.
 - a. Cable: Stainless steel core wire in stainless steel with polytetrafluoroethylene (Teflon®) liner color-coded to latches and center slides. Conduit and core wire ends snap into latch and center slides without use of tools.
 - b. Latchbolts and Blocking Cams: Manufactured from sintered metal low carbon copper- infiltrated steel, with molybdenum disulfide low friction coating.
 - c. Top Latchbolt: Minimum 0.382 inch (10 mm) and greater than 90 degree engagement with strike to prevent door and frame separation under high static load.
 - d. Bottom Latchbolt: Minimum of 0.44 inch (11 mm) engagement with strike.
 - e. Product Cycle Life: 1,000,000 cycles.
 - f. Latch Operation: Top and bottom latch operate independently of each other. Top latch fully engages top strike even when bottom latch is compromised. Separate trigger mechanisms not permitted.
 - g. Latch release does not require separate trigger mechanism.
 - h. Cable and latching system characteristics:
 - 1) Assembled prior to being installed in door.
 - 2) Installed in door as complete assembly.
 - 3) Installed independently of exit device installation, and capable of functioning on door prior to device and trim installation.
 - 4) Connected to exit device at single attachment point.
 - 5) Bottom latch height adjusted from single point, after system is installed and connected to exit device, while door is hanging
 - 6) Latch position altered up and down 2 inches (51 mm) without additional adjustment.
 - 7) System may be removed while door is hanging.

- 8) Configure latchbolt mounting: double or single tab mount for steel doors, and wood doors, face mount for aluminum doors, eliminating requirement of tabs.
 - 9) Provide adjustable exit device to latch center line adjustment. Ensures double tab mounting option for top latch, regardless of exit device centerline.
- 7. Provide exit devices with manufacturer's approved strikes.
 - 8. Provide exit devices cut to door width and height. Locate exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
 - 9. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
 - 10. Provide cylinder dogging at non-fire-rated exit devices, unless specified less dogging.
 - 11. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion that is removed by use of a keyed cylinder, which is self-locking when re-installed.
 - 12. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant levers that will travel to 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.
 - a. Lever Style: Match lever style of locksets.
 - b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.
 - 13. Provide UL labeled fire exit hardware for fire rated openings.
 - 14. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
 - 15. Provide electrical options as scheduled.

2.10 POWER SUPPLIES

A. Manufacturers and Products:

- 1. Scheduled Manufacturer and Product: Schlage Electronics or Von Duprin PS900 series
- 2. Acceptable Manufacturers and Products: No Substitute

B. Requirements:

- 1. Provide power supplies, recommended and approved by manufacturer of electrified locking component, for operation of electrified locks, electrified exit devices, magnetic locks, electric strikes, and other components requiring power supply.
- 2. Provide appropriate quantity of power supplies necessary for proper operation of electrified locking components as recommended by manufacturer of electrified locking components with consideration for each electrified component using power supply, location of power supply, and approved wiring diagrams. Locate power supplies as directed by Architect.
- 3. Provide regulated and filtered 24 VDC power supply, and UL class 2 listed.
- 4. Options:

- a. Provide power supply, where specified, with internal capability of charging sealed backup batteries 24 VDC, in addition to operating DC load.
 - b. Provide sealed batteries for battery back-up at each power supply where specified.
 - c. Provide keyed power supply cabinet.
- 5. Provide power supply in an enclosure, complete, and requiring 120VAC to fused input.
 - 6. Provide power supply with emergency release terminals, where specified, that allow release of all devices upon activation of fire alarm system complete with fire alarm input for initiating "no delay" exiting mode.

2.11 CYLINDERS

- A. Manufacturer:
 - 1. Scheduled Manufacturer: Schlage, No Substitute
- B. Requirements: Provide cylinders/cores complying with the following requirements.
 - 1. Furnished by same manufacturer as locks.
 - 2. Cylinders/cores compliant with ANSI/BHMA A156.5; latest revision, Section 12, Grade 1; permanent cylinders; cylinder face finished to match lockset, manufacturer's series as indicated.
- C. Full-sized cylinders in the below-listed configuration(s), distributed throughout the Project as indicated.
 - 1. High Security cylinder with interchangeable core (LFIC) core with keyway compatible with existing system.
- D. Keying:
 - 1. Locksmith-keyed permanent cylinders/cores, configured into existing keying system per "KEYING" article herein.
 - a. A1 Security, Springfield, IL, Todd Feiffer (217)744-7575
- E. Features: Cylinders/cores shall incorporate the following features.
 - 1. Nickel silver bottom pins.
- F. Identification:
 - 1. Mark permanent cylinders/cores and keys with applicable blind code per DHI publication "Keying Systems and Nomenclature" for identification. Blind code marks shall not include actual key cuts.
 - 2. Identification stamping provisions must be approved by the Architect and Owner.
 - 3. Failure to comply with stamping requirements shall be cause for replacement of cylinders/cores involved at no additional cost to Owner.
- G. Forward cylinders/cores to Owner, separately from keys, by means as directed by Owner.
- H. Replaceable Construction Cores.

1. Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
 - a. 20 construction change (day) keys.
 - b. 3 construction control keys.
 - c. Owner or Owner's Representative will replace temporary construction cores with permanent cores.

2.12 KEYING

- A. Keying System: Factory registered existing system maintained by Owner or Owners representative, incorporating decisions made at keying conference.
- B. Keying system tied into existing system as directed by the Owner.
 1. Forward biting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements shall be cause for replacement of cylinders/cores involved at no additional cost to Owner.
- C. Key Features: Provide keys with the following features.
 1. Patent Protection: Keys and blanks protected by one or more utility patent(s).
- D. Keys
 1. Material: Nickel silver; minimum thickness of .092-inch (2.3mm)
 2. Identification:
 - a. Coordinate with cylinder/core and key identification requirements above.
 - b. Stamp keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
 - c. Failure to comply with stamping requirements shall be cause for replacement of keys involved at no additional cost to Owner.
 3. Quantity: Furnish in the following quantities.
 - a. Change (Day) Keys: 3 per cylinder/core.
 - b. Permanent Control Keys: 3.
 - c. Master Keys: 6.
 - d. Unused balance of key blanks shall be furnished to Owner with the cut keys.

2.13 KEY CONTROL SYSTEM

- A. Key Control System Manufacturers:
 1. Scheduled Manufacturer: Telkee
 2. Acceptable Manufacturers: HPC, Lund
- B. Requirements:
 1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent

markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.

- a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
- b. Provide hinged-panel type cabinet for wall mounting.

2.14 DOOR CLOSERS

A. Manufacturer and Product: LCN 4040XP series. No Substitute

B. Requirements:

1. Provide door closers certified to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2 inch (38 mm) diameter with 11/16 inch (17 mm) diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers. When closers are parallel arm mounted, provide closers which mount within 6-inch (152 mm) top rail without use of mounting plate so that closer is not visible through vision panel from pull side.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.15 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Hiawatha, Trimco.

B. Requirements:

1. Provide push plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick and beveled 4 edges. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.

2. Provide push bars of solid bar stock, diameter and length as scheduled. Provide push bars of sufficient length to span from center to center of each stile. Where required, mount back to back with pull.
3. Provide offset pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
4. Provide flush pulls as specified. Where required, provide back-to-back mounted model.
5. Provide pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
6. Provide pull plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick, beveled 4 edges, and prepped for pull. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
7. Provide wire pulls of solid bar stock, diameter and length as scheduled.

2.16 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Hiawatha, Trimco.

B. Requirements:

1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch (1 mm) thick as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes of plates:
 - a. Kick Plates: 10 inches (254 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
 - b. Mop Plates: 4 inches (102 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
 - c. Armor Plates: 36 inches (914 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs

2.17 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers: Glynn-Johnson
2. Acceptable Manufacturers: No Substitute

B. Requirements:

1. Provide heavy duty concealed mounted overhead stop or holder as specified for exterior and interior vestibule single acting doors.
2. Provide heavy duty concealed mounted overhead stop or holder as specified for double acting doors.
3. Provide heavy duty and concealed or surface mounted overhead stop or holder for interior doors as specified. Provide heavy duty surface mounted overhead stop for interior doors and at any door that swings more than 140 degrees before striking wall, open against equipment, casework, sidelights, and where conditions do not allow wall stop or floor stop presents tripping hazard.
4. Where overhead holders are specified provide friction type at doors without closer and positive type at doors with closer.

2.18 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Hiawatha, Trimco.

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

2.19 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer: National Guard.
2. Acceptable Manufacturers: Reese, Zero.

B. Requirements:

1. Provide thresholds, weatherstripping (including door sweeps, seals, astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
2. Size of thresholds::
 - a. Saddle Thresholds: 1/2 inch (13 mm) high by jamb width by door width
 - b. Bumper Seal Thresholds: 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width
3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

2.20 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Hiawatha, Trimco.

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.21 FINSHES

A. Finish: BHMA 626/652 (US26D); except:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Continuous Hinges: BHMA 628 (US28)
3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
4. Protection Plates: BHMA 630 (US32D)
5. Overhead Stops and Holders: BHMA 630 (US32D)
6. Door Closers: Powder Coat to Match
7. Wall Stops: BHMA 630 (US32D)
8. Latch Protectors: BHMA 630 (US32D)
9. Weatherstripping: Clear Anodized Aluminum
10. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prior to installation of hardware, 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. Existing Door and Frame Compatibility: Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.
- C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Where on-site modification of doors and frames is required:
 1. Remove existing hardware being replaced, tag, and store according to contract documents.
 2. Field modify and prepare existing door and frame for new hardware being installed.
 3. When modifications are exposed to view, use concealed fasteners, when possible.
 4. Prepare hardware locations in accordance with:
 - 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: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
 - c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

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.
 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
 - C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
 - D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
 - E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
 - F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
 - G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity 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.
 - H. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 1. Replace construction cores with permanent cores as indicated in keying section.
 2. Furnish permanent cores to Owner for installation.
 - I. Wiring: Coordinate with Division 26, ELECTRICAL sections for:
 1. Conduit, junction boxes and wire pulls.
 2. Connections to and from power supplies to electrified hardware.
 3. Connections to fire/smoke alarm system and smoke evacuation system.
 4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
 5. Testing and labeling wires with Architect's opening number.
 - J. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
 - K. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers shall not be visible in corridors, lobbies and other public spaces unless approved by Architect.
 - L. Closer/holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
 - M. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.
 1. Configuration: Provide one power supply for each door opening with electrified door hardware.
 - N. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

- O. 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 may impede traffic or present tripping hazard.
- P. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- Q. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- R. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 FIELD QUALITY CONTROL

- A. Architectural Hardware Consultant: Engage qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
 - 1. Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 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. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
 - 2. 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.

3.6 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 door hardware is without damage or deterioration at time of Substantial Completion.

3.7 DEMONSTRATION

- A. Provide training for Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.8 DOOR HARDWARE SCHEDULE

- A. Locksets, exit devices, and other hardware items are referenced in the following hardware sets for series, type and function. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.
- B. Hardware Sets:

HARDWARE SET # 01

FOR USE ON DOOR #(S):

1100.1 1101.1 1101.4 1109.2

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112HD EPT	628	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	QEL+-9949-L-DT-06	626	VON
1	EA	ELEC PANIC HARDWARE	QEL+-9949-L-NL-06	626	VON
1	EA	RIM CYLINDER	20-057	626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	MOUNTING PLATE	4040-18	689	LCN
2	EA	BLADE STOP SPACER	4040-61	689	LCN
2	EA	DOOR SWEEP	200NA	CL	NGP
1	EA	PANIC THRESHOLD	896S	719	NGP
1	EA	POWER SUPPLY	PS904 900-2RS	LGR	SCE
			CARD READER BY OTHERS		
			DOOR CONTACT(S) BY OTHERS		
1	EA		WEATHERSTRIP BY DOOR/FRAME MANUFACTURER		

*CARD ACCESS SYSTEM, READER, WIRING AND CONNECTIONS BY SECURITY PROVIDER.

HARDWARE SET # 02

FOR USE ON DOOR #(S):

1100.2 1100.3 1100.4 1101.2 1101.3 1109.1

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112HD	628	IVE
2	EA	PANIC HARDWARE	9949-L-DT-06	626	VON
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	MOUNTING PLATE	4040-18	689	LCN
2	EA	BLADE STOP SPACER	4040-61	689	LCN
2	EA	DOOR SWEEP	200NA	CL	NGP
1	EA	PANIC THRESHOLD	896S	719	NGP
			DOOR CONTACT(S) BY OTHERS		
1	EA		WEATHERSTRIP BY DOOR/FRAME MANUFACTURER		

HARDWARE SET # 03

FOR USE ON DOOR #(S):

1100.5 1100.6 1100.7 1100.8 1109.3 1109.4

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112HD	628	IVE
2	EA	PANIC HARDWARE	9949-L-BE-06-249-LBL	626	VON
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	MOUNTING PLATE	4040-18	689	LCN
2	EA	BLADE STOP SPACER	4040-61	689	LCN

HARDWARE SET # 04

FOR USE ON DOOR #(S):

1001.5 1001.7 1117.1

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	224HD EPT	628	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	QEL+-9949-L-DT-06	626	VON
1	EA	ELEC PANIC HARDWARE	QEL+-9949-L-NL-06	626	VON
1	EA	RIM CYLINDER	20-057	626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B4E	630	IVE
1	EA	DRIP CAP	16A	CL	NGP
1	SET	SEALS	5050B	BRN	NGP
1	SET	SEALS	5075B	BRN	NGP
2	EA	DOOR SWEEP	200NA	CL	NGP
1	EA	PANIC THRESHOLD	896S	719	NGP
1	EA	POWER SUPPLY	PS904 900-2RS	LGR	SCE
			CARD READER BY OTHERS		
			DOOR CONTACT(S) BY OTHERS		

*CARD ACCESS SYSTEM, READER, WIRING AND CONNECTIONS BY SECURITY PROVIDER.

HARDWARE SET # 05

FOR USE ON DOOR #(S):

1001.6

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	224HD	628	IVE
2	EA	PANIC HARDWARE	9949-L-DT-06	626	VON

2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B4E	630	IVE
1	EA	DRIP CAP	16A	CL	NGP
1	SET	SEALS	5050B	BRN	NGP
1	SET	SEALS	5075B	BRN	NGP
2	EA	DOOR SWEEP	200NA	CL	NGP
1	EA	PANIC THRESHOLD	896S	719	NGP
			DOOR CONTACT(S) BY OTHERS		

HARDWARE SET # 06

FOR USE ON DOOR #(S):

1011.3 1013.3

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224HD EPT	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	QEL+-99-L-NL-06	626	VON
1	EA	RIM CYLINDER	20-057	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	DRIP CAP	16A	CL	NGP
1	SET	SEALS	5050B	BRN	NGP
1	EA	DOOR SWEEP	200NA	CL	NGP
1	EA	PANIC THRESHOLD	896S	719	NGP
1	EA	POWER SUPPLY	PS902	LGR	SCE
			CARD READER BY OTHERS		

*CARD ACCESS SYSTEM, READER, WIRING AND CONNECTIONS BY SECURITY PROVIDER.

HARDWARE SET # 07

FOR USE ON DOOR #(S):

1118.2

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224HD EPT	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	QEL+-99-L-NL-06	626	VON
1	EA	RIM CYLINDER	20-057	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	DRIP CAP	16A	CL	NGP
1	SET	SEALS	5050B	BRN	NGP
1	EA	DOOR SWEEP	200NA	CL	NGP
1	EA	PANIC THRESHOLD	896S	719	NGP
1	EA	POWER SUPPLY	PS902	LGR	SCE

CARD READER BY OTHERS

*CARD ACCESS SYSTEM, READER, WIRING AND CONNECTIONS BY SECURITY PROVIDER.

HARDWARE SET # 08

FOR USE ON DOOR #(S):

1014.3 ALT1-1015.2 ALT2-1015.2 ALT3-1016.2

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224HD	628	IVE
1	EA	CONT. HINGE	224HD EPT	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	SET	CONST LATCHING BOLT	FB51P	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	ND80RD RHO	626	SCH
1	EA		ELECTRIC STRIKE BY OTHERS		
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B4E	630	IVE
1	EA	DRIP CAP	16A	CL	NGP
1	SET	SEALS	5050B	BRN	NGP
1	SET	SEALS	5075B	BRN	NGP
2	EA	DOOR SWEEP	200NA	CL	NGP
1	EA	PANIC THRESHOLD	896S	719	NGP
1	EA	POWER SUPPLY	PS902	LGR	SCE

CARD READER BY OTHERS

*CARD ACCESS SYSTEM, READER, ELECTRIC STRIKE, WIRING AND CONNECTIONS BY SECURITY PROVIDER.

HARDWARE SET # 09

FOR USE ON DOOR #(S):

ALT2-1015.1 ALT3-1015.1 ALT3-1016.1

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224HD	628	IVE
1	EA	CONT. HINGE	224HD EPT	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	SET	CONST LATCHING BOLT	FB51P	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	ND80RD RHO	626	SCH
1	EA		ELECTRIC STRIKE BY OTHERS		
2	EA	OH STOP	90S	630	GLY
2	EA	SURFACE CLOSER	4040XP	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B4E	630	IVE
1	SET	SEALS	5050B	BRN	NGP

1	SET	SEALS	5075B	BRN	NGP
1	EA	SADDLE THRESHOLD	425	719	NGP
1	EA	POWER SUPPLY	PS902	LGR	SCE
CARD READER BY OTHERS					

*CARD ACCESS SYSTEM, READER, ELECTRIC STRIKE, WIRING AND CONNECTIONS BY SECURITY PROVIDER.

HARDWARE SET # 10

FOR USE ON DOOR #(S):

1111.2 1112.2

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224HD	628	IVE
1	EA	STOREROOM LOCK	ND80RD RHO	626	SCH
1	EA		ELECTRIC STRIKE BY OTHERS		
1	EA	SURFACE CLOSER	4040XP	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	SET	SEALS	5050B	BRN	NGP
1	EA	SADDLE THRESHOLD	425	719	NGP
1	EA	POWER SUPPLY	PS902	LGR	SCE
CARD READER BY OTHERS					

*CARD ACCESS SYSTEM, READER, ELECTRIC STRIKE, WIRING AND CONNECTIONS BY SECURITY PROVIDER.

HARDWARE SET # 11

FOR USE ON DOOR #(S):

1118.1 2108

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	FIRE EXIT HARDWARE	99-L-F-06	626	VON
1	EA	RIM CYLINDER	20-057	626	SCH
1	EA	SURFACE CLOSER	4040XP	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	SET	SEALS	5050B	BRN	NGP

HARDWARE SET # 12
FOR USE ON DOOR #(S):

1000.2

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	QEL+-9949-L-DT-06-249-LBL	626	VON
1	EA	ELEC PANIC HARDWARE	QEL+-9949-L-NL-06-249-LBL	626	VON
1	EA	RIM CYLINDER	20-057	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B4E	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	POWER SUPPLY	PS904 900-2RS	LGR	SCE
			CARD READER BY OTHERS		
			DOOR CONTACT(S) BY OTHERS		

*CARD ACCESS SYSTEM, READER, WIRING AND CONNECTIONS BY SECURITY PROVIDER.

HARDWARE SET # 13
FOR USE ON DOOR #(S):

1000.5 1001.1 1001.4

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	QEL+-9949-L-DT-06-249-LBL	626	VON
1	EA	ELEC PANIC HARDWARE	QEL+-9949-L-NL-06-249-LBL	626	VON
1	EA	RIM CYLINDER	20-057	626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B4E	630	IVE
1	EA	POWER SUPPLY	PS904 900-2RS	LGR	SCE
			CARD READER BY OTHERS		
			DOOR CONTACT(S) BY OTHERS		

*CARD ACCESS SYSTEM, READER, WIRING AND CONNECTIONS BY SECURITY PROVIDER.

HARDWARE SET # 14
FOR USE ON DOOR #(S):

2000

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	QEL+-9949-L-DT-06-249-LBL	626	VON
1	EA	ELEC PANIC HARDWARE	QEL+-9949-L-NL-06-249-LBL	626	VON
1	EA	RIM CYLINDER	20-057	626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B4E	630	IVE
1	EA	POWER SUPPLY	PS904 900-2RS	LGR	SCE
			CARD READER BY OTHERS		

*CARD ACCESS SYSTEM, READER, WIRING AND CONNECTIONS BY SECURITY PROVIDER.

HARDWARE SET # 15
FOR USE ON DOOR #(S):

1000.1

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	QEL+-9949-L-DT-06-249-LBL	626	VON
1	EA	ELEC PANIC HARDWARE	QEL+-9949-L-NL-06-249-LBL	626	VON
1	EA	RIM CYLINDER	20-057	626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B4E	630	IVE
1	EA	POWER SUPPLY	PS904 900-2RS	LGR	SCE
			CARD READER BY OTHERS		
			DOOR CONTACT(S) BY OTHERS		

*CARD ACCESS SYSTEM, READER, WIRING AND CONNECTIONS BY SECURITY PROVIDER.

HARDWARE SET # 16

FOR USE ON DOOR #(S):

1000.3

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
2	EA	PANIC HARDWARE	9949-L-DT-06-249-LBL	626	VON
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B4E	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
DOOR CONTACT(S) BY OTHERS					

HARDWARE SET # 17

FOR USE ON DOOR #(S):

1117.2

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW 4.5 X 4.5	630	IVE
2	EA	PANIC HARDWARE	9949-L-BE-06-249-LBL	626	VON
2	EA	SURFACE CLOSER	4040XP EDA	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B4E	630	IVE
2	EA	WALL STOP	WS406/407CVX	630	IVE

HARDWARE SET # 18

FOR USE ON DOOR #(S):

1000.4 1001.2 1001.3

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
2	EA	PANIC HARDWARE	9949-L-DT-06-249-LBL	626	VON
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B4E	630	IVE
DOOR CONTACT(S) BY OTHERS					

HARDWARE SET # 19
FOR USE ON DOOR #(S):

1014.2

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1 4.5 X 4.5	630	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	CONST LATCHING BOLT	FB51T	630	IVE
1	EA	STOREROOM LOCK	ND80RD RHO	626	SCH
1	EA		ELECTRIC STRIKE BY OTHERS		
1	EA	OH STOP	90S	630	GLY
1	EA	SURFACE CLOSER	4040XP	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B4E	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	POWER SUPPLY	PS902	LGR	SCE
			CARD READER BY OTHERS		

*CARD ACCESS SYSTEM, READER, ELECTRIC STRIKE, WIRING AND CONNECTIONS BY SECURITY PROVIDER.

HARDWARE SET # 20
FOR USE ON DOOR #(S):

1014.1

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	CONST LATCHING BOLT	FB51T	630	IVE
1	EA	STOREROOM LOCK	ND80RD RHO	626	SCH
1	EA		ELECTRIC STRIKE BY OTHERS		
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B4E	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	POWER SUPPLY	PS902	LGR	SCE
			CARD READER BY OTHERS		

*CARD ACCESS SYSTEM, READER, ELECTRIC STRIKE, WIRING AND CONNECTIONS BY SECURITY PROVIDER.

HARDWARE SET # 21
FOR USE ON DOOR #(S):

1119

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5	630	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	CONST LATCHING BOLT	FB51T	630	IVE
1	EA	STOREROOM LOCK	ND80RD RHO	626	SCH
1	EA		ELECTRIC STRIKE BY OTHERS		
1	EA	SURFACE CLOSER	4040XP	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B4E	630	IVE
2	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	POWER SUPPLY	PS902	LGR	SCE
			CARD READER BY OTHERS		

*CARD ACCESS SYSTEM, READER, ELECTRIC STRIKE, WIRING AND CONNECTIONS BY SECURITY PROVIDER.

HARDWARE SET # 22
FOR USE ON DOOR #(S):

ALT1-1015.1

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	CONST LATCHING BOLT	FB51T	630	IVE
1	EA	STOREROOM LOCK	ND80RD RHO	626	SCH
1	EA		ELECTRIC STRIKE BY OTHERS		
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B4E	630	IVE
1	EA	POWER SUPPLY	PS902	LGR	SCE
			CARD READER BY OTHERS		

*CARD ACCESS SYSTEM, READER, ELECTRIC STRIKE, WIRING AND CONNECTIONS BY SECURITY PROVIDER.

HARDWARE SET # 23

FOR USE ON DOOR #(S):

1011.1	1013.1	2001.1	2001.2	2002.1	2002.2
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EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	QEL+-99-L-NL-06	626	VON
1	EA	RIM CYLINDER	20-057	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	POWER SUPPLY	PS902	LGR	SCE
			CARD READER BY OTHERS		

*CARD ACCESS SYSTEM, READER, WIRING AND CONNECTIONS BY SECURITY PROVIDER.

HARDWARE SET # 24

FOR USE ON DOOR #(S):

1002	1003.1	1004.1	1006	1007	1012
1102A	1102B	2001A	2005	2007	2008
2009	2011	2012	2013	2014	2015
2016	2017	2018	2019	2020	2021
2023	2024	2025	2107		

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	630	IVE
1	EA	STOREROOM LOCK	ND80RD RHO	626	SCH
1	EA		ELECTRIC STRIKE BY OTHERS		
1	EA	SURFACE CLOSER	4040XP	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	POWER SUPPLY	PS902	LGR	SCE
			CARD READER BY OTHERS		

*CARD ACCESS SYSTEM, READER, ELECTRIC STRIKE, WIRING AND CONNECTIONS BY SECURITY PROVIDER.

HARDWARE SET # 25

FOR USE ON DOOR #(S):

1008	1106	1108A.2	1108B	1108C	1113
1114	1115	1116	2102	2103	2105

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	ND80RD RHO	626	SCH
1	EA		ELECTRIC STRIKE BY OTHERS		
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	POWER SUPPLY	PS902	LGR	SCE
			CARD READER BY OTHERS		

*CARD ACCESS SYSTEM, READER, ELECTRIC STRIKE, WIRING AND CONNECTIONS BY SECURITY PROVIDER.

HARDWARE SET # 26

FOR USE ON DOOR #(S):

1111.1	1112.1
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EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	630	IVE
1	EA	INSTITUTION LOCK	ND82RD RHO	626	SCH
1	EA		ELECTRIC STRIKE BY OTHERS		
1	EA	SURFACE CLOSER	4040XP	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	POWER SUPPLY	PS902	LGR	SCE
			CARD READER BY OTHERS		

*CARD ACCESS SYSTEM, READER, ELECTRIC STRIKE, WIRING AND CONNECTIONS BY SECURITY PROVIDER.

HARDWARE SET # 27

FOR USE ON DOOR #(S):

1003.2	1004.2	1005	1009	2003	2010
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EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	ND80RD RHO	626	SCH
1	EA		ELECTRIC STRIKE BY OTHERS		
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE

1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	POWER SUPPLY	PS902	LGR	SCE
			CARD READER BY OTHERS		

*CARD ACCESS SYSTEM, READER, ELECTRIC STRIKE, WIRING AND CONNECTIONS BY SECURITY PROVIDER.

HARDWARE SET # 28

FOR USE ON DOOR #(S):

1108A.1

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	ND80RD RHO	626	SCH
1	EA		ELECTRIC STRIKE BY OTHERS		
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	SET	SEALS	5050B	BRN	NGP
1	EA	POWER SUPPLY	PS902	LGR	SCE
			CARD READER BY OTHERS		

*CARD ACCESS SYSTEM, READER, ELECTRIC STRIKE, WIRING AND CONNECTIONS BY SECURITY PROVIDER.

*STRIKE MUST BE FAIL SECURE

HARDWARE SET # 29

FOR USE ON DOOR #(S):

1011.2 1013.2

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5	630	IVE
1	EA	PUSH PLATE	8200 6" X 16"	630	IVE
1	EA	PULL PLATE	8303 10" 4" X 16"	630	IVE
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE

HARDWARE SET # 30
FOR USE ON DOOR #(S):

1103 1104 2101 2104

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5	630	IVE
1	EA	CLASSROOM DEADBOLT	B663R	626	SCH
1	EA	PUSH PLATE	8200 6" X 16"	630	IVE
1	EA	PULL PLATE	8303 10" 4" X 16"	630	IVE
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE

HARDWARE SET # 31
FOR USE ON DOOR #(S):

1010 1107

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1	EA	PRIVACY LOCK	ND40S RHO	626	SCH
1	EA	WALL STOP	WS406/407CVX	630	IVE

HARDWARE SET # 32
FOR USE ON DOOR #(S):

2004

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	630	IVE
1	EA	STOREROOM LOCK	ND80RD RHO	626	SCH
1	EA	ELECTRIC STRIKE BY OTHERS			
1	EA	OH STOP	90S	630	GLY
1	EA	SURFACE CLOSER	4040XP	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	POWER SUPPLY	PS902	LGR	SCE
		CARD READER BY OTHERS			

*CARD ACCESS SYSTEM, READER, ELECTRIC STRIKE, WIRING AND CONNECTIONS BY SECURITY PROVIDER.

END OF SECTION 08 71 00

SECTION 08 80 00 - 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.
 - 2. Storefront framing.
 - 3. Glazed entrances.
 - 4. Interior borrowed lites.
- B. Related Sections:
 - 1. Section 08 41 26 "All-Glass Entrances and Storefronts."

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. Delegated Design: Design glass, including comprehensive engineering analysis according to ICC's 2003 International Building Code by a qualified professional engineer, using the following design criteria:
 - 1. Design Wind Pressures: As indicated on Drawings.

2. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
 3. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
 4. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- C. 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, ambient; 180 deg F, material surfaces.

1.5 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
1. Testing will not be required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.6 ACTION SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. LEED Submittals:
1. Product Data for Credit IEQ 4.1: For glazing sealants used inside the weatherproofing system, documentation including printed statement of VOC content.
 2. Laboratory Test Reports for Credit IEQ 4: For glazing sealants used inside the weatherproofing system, documentation indicating that they comply 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."
- C. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
1. Tinted glass.
 2. Laminated glass with colored interlayer.

3. Insulating glass.
- D. Glazing Accessory Samples: For sealants and colored spacers, in 12-inch lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
 - E. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.
- B. 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.
- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
- E. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
- F. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.
- G. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 1. GANA Publications: GANA's "Glazing Manual."
 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- H. 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 or the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- I. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- J. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 1. Install glazing in mockups specified in Section 08 41 13 "Aluminum-Framed Entrances and Storefronts" -to match glazing systems required for Project,

- including glazing methods.
- 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

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.

1.10 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

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.
 2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
- B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. 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 of thickness indicated.
 2. For laminated-glass lites, properties are based on products of construction indicated.
 3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
 5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

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.
 3. For coated vision glass, comply with requirements for Condition C (other coated glass).

- C. Tempered Patterned Glass: ASTM C 1048, Kind FT (fully tempered), Type II, Class 1 (clear), Form 3; Quality-Q6, Finish F1 (patterned one side), [Pattern P1 (linear)] [Pattern P2 (geometric)] [Pattern P3 (random)] [Pattern P4 (special)].

2.3 LAMINATED GLASS

- A. Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
 - 1. Construction: Laminate glass with polyvinyl butyral interlayer or cast-in-place and cured-transparent-resin interlayer to comply with interlayer manufacturer's written recommendations.
 - 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 - 3. Interlayer Color: Clear unless otherwise indicated.

2.4 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
 - 1. Sealing System: Dual seal, with manufacturer's standard primary and secondary.
 - 2. Spacer: Manufacturer's standard spacer material and construction .
- B. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Insulating-Glass Types" Article.

2.5 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
 - 1. EPDM complying with ASTM C 864.
 - 2. Silicone complying with ASTM C 1115.
 - 3. Thermoplastic polyolefin rubber complying with ASTM C 1115.
- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned EPDM, silicone or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
 - 1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.
- C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.6 GLAZING SEALANTS

A. General:

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Sealants used inside the weatherproofing system, shall have a VOC content of not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 790.
 - b. May National Associates, Inc.; Bondaflex Sil 290.
 - c. Pecora Corporation; 890.
 - d. Sika Corporation, Construction Products Division; SikaSil-C990.
 - e. Tremco Incorporated; Spectrem 1.

C. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 795.
 - b. May National Associates, Inc.; Bondaflex Sil 295.
 - c. Pecora Corporation; 895.
 - d. Sika Corporation, Construction Products Division; SikaSil-C995.
 - e. Tremco Incorporated; Spectrem 2.

2.7 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.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 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.

2.9 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.

2.10 MONOLITHIC-GLASS TYPES

- A. Glass Type GL-01: Clear fully tempered float glass.

1. Thickness: minimum 6.0 mm (1/4 inch).
2. Provide safety glazing labeling.

2.11 LAMINATED-GLASS TYPES

A. Glass Type GL-30: Clear laminated glass with two plies of fully tempered float glass.

1. Thickness of Each Glass Ply: minimum 5.0 mm.
2. Interlayer Thickness: 0.030 inch.
3. Provide safety glazing labeling.

2.12 INSULATING-GLASS TYPES

A. Glass Type GL-10: Low-e-coated, clear insulating glass.

1. Overall Unit Thickness: 1 inch.
2. Thickness of Each Glass Lite: 6.0 mm (1/4 inch).
3. Outdoor Lite: Fully tempered float glass.
4. Interspace Content: Air.
5. Indoor Lite: Fully tempered float glass.
6. Low-E Coating: Sputtered on second surface.

a. Basis-of-Design: PPG Industries; Solarban 60.

7. Provide safety glazing labeling.

B. Glass Type GL-11: Low-e-coated, tinted insulating glass.

1. Overall Unit Thickness: 1 inch.
2. Thickness of Each Glass Lite: 6.0 mm (1/4 inch).
3. Outdoor Lite: Tinted fully tempered float glass.

a. Basis-of-Design: PPG Solargray.

4. Interspace Content: Air.
5. Indoor Lite: Clear fully tempered float glass.
6. Low-E Coating: Sputtered on second surface.

a. Basis-of-Design: PPG Industries; Solarban 60.

7. Provide safety glazing labeling.

C. Glass Type GL-12: Low-e-coated, clear insulating glass.

1. Overall Unit Thickness: 1 inch.
2. Thickness of Each Glass Lite: 6.0 mm (1/4 inch).
3. Outdoor Lite: Fully tempered float glass.

a. Provide 100% white velour frit on surface 2.

4. Interspace Content: Air.
5. Indoor Lite: Fully tempered float glass.

- 6. Low-E Coating: Sputtered on third surface.
 - a. Basis-of-Design: PPG Industries; Solarban 60.
- 7. Provide safety glazing labeling.
- D. Glass Type GL-20: Low-e-coated, clear insulating glass used as spandrel panel.
 - 1. Overall Unit Thickness: 1 inch.
 - 2. Thickness of Each Glass Lite: 6.0 mm (1/4 inch).
 - 3. Outdoor Lite: Fully tempered float glass.
 - a. Provide white velour frit (100% coverage) on surface 2.
 - 4. Interspace Content: Air.
 - 5. Indoor Lite: Fully tempered float glass.
 - a. Provide white paint (100% coverage) on surface 4.
 - 6. Low-E Coating: Sputtered on third surface.
 - a. Basis-of-Design: PPG Industries; Solarban 60.
- E. Provide safety glazing labeling.

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.
 - 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 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 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 LOCK-STRIP GASKET GLAZING

- A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system unless otherwise indicated.

3.8 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 08 80 00

SECTION 09 21 16.23 - GYPSUM BOARD SHAFT WALL ASSEMBLIES

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: Gypsum board shaft wall assemblies.

1.3 ACTION SUBMITTALS

- A. Product Data: For each component of gypsum board shaft wall assembly.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
 - 2. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project, cost for each regional material, and fraction by weight that is considered regional.

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For shaft wall assemblies, from ICC-ES.

1.5 DELIVERY, STORAGE, AND HANDLING

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

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or with gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install interior products until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, or mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

2.2 GYPSUM BOARD SHAFT WALL ASSEMBLIES

- A. Fire-Resistance Rating: 2 hours.
- B. Studs: Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated.
 1. Depth: As indicated.
 2. Minimum Base-Metal Thickness: 0.033 inch.
- C. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2 inches long and matching studs in depth.
 1. Minimum Base-Metal Thickness: Matching steel studs.
- D. Firestop Tracks: Provide firestop track at head of shaft wall on each floor level.
- E. Elevator Hoistway Entrances: Manufacturer's standard J-profile jamb strut with long-leg length of 3 inches, matching studs in depth, and not less than 0.033 inch thick.
- F. Room-Side Finish: Gypsum board .
- G. Shaft-Side Finish: Gypsum shaftliner board, moisture- and mold-resistant Type X .
- H. Insulation: Sound attenuation blankets.

2.3 PANEL PRODUCTS

- A. Recycled Content of Gypsum Panel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent by weight.
- B. Regional Materials: Gypsum panel products shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- C. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

- D. Gypsum Shaftliner Board, Moisture- and Mold-Resistant Type X: ASTM C 1396/C 1396M; manufacturer's proprietary fire-resistive liner panels with moisture- and mold-resistant core and surfaces.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; ProRoc Moisture and Mold Resistant Shaftliner.
 - b. Georgia-Pacific Gypsum LLC, Subsidiary of Georgia Pacific; Dens-Glass Ultra Shaftliner.
 - c. Lafarge North America, Inc.; Firecheck Moldcheck Type X Shaftliner.
 - d. National Gypsum Company; Gold Bond Brand Fire-Shield Shaftliner XP.
 - e. PABCO Gypsum; Pabcore Mold Curb Shaftliner Type X.
 - f. Temple-Inland Inc.; Fire-Rated SilentGuard TS Mold-Resistant Gypsum Shaftliner System.
 - g. USG Corporation; Sheetrock Brand Mold Tough Gypsum Liner Panel.
 2. Thickness: 1 inch.
 3. Long Edges: Double bevel.
 4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- E. Gypsum Board: As specified in Section 09 29 00 "Gypsum Board."

2.4 NON-LOAD-BEARING STEEL FRAMING

- A. Recycled Content of Steel: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Steel Framing Members: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
1. Protective Coating: ASTM A 653/A 653M, G60, hot-dip galvanized unless otherwise indicated.
- C. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fire Trak Corp.; Fire Trak System attached to studs with Fire Trak Posi Klip.
 - b. Grace Construction Products; FlameSafe FlowTrak System.
 - c. Metal-Lite, Inc.; The System.
 - d. Steel Network Inc. (The); VertiClip SLD Series.

2.5 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with manufacturer's written recommendations.
- B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes as specified in Section 092900 "Gypsum Board" that comply with gypsum board shaft wall assembly manufacturer's written recommendations for application indicated.
- C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
- D. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.
 - 1. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing according to ASTM E 488 conducted by a qualified testing agency.
 - 2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing according to ASTM E 1190 conducted by a qualified testing agency.
- E. Sound Attenuation Blankets: As specified in Section 09 29 00 "Gypsum Board."
- F. Acoustical Sealant: As specified in Section 09 29 00 "Gypsum Board."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to which gypsum board shaft wall assemblies attach or abut, with Installer present, including hollow-metal frames, elevator hoistway door frames, cast-in anchors, and structural framing. Examine for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Sprayed Fire-Resistive Materials: Coordinate with gypsum board shaft wall assemblies so both elements of Work remain complete and undamaged. Patch or replace sprayed fire-resistive materials removed or damaged during installation of shaft wall assemblies to comply with requirements specified in Section 07 81 00 "Applied Fireproofing."

- B. After sprayed fire-resistive materials are applied, remove only to extent necessary for installation of gypsum board shaft wall assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

3.3 INSTALLATION

- A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and ASTM C 754 other than stud-spacing requirements.
- B. Do not bridge building expansion joints with shaft wall assemblies; frame both sides of expansion joints with furring and other support.
- C. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, wall-mounted door stops, and similar items that cannot be supported directly by shaft wall assembly framing.
 - 1. Elevator Hoistway: At elevator hoistway-entrance door frames, provide jamb struts on each side of door frame.
- D. Penetrations: At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.
- E. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels, while maintaining continuity of fire-rated construction.
- F. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
- G. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect while maintaining fire-resistance rating of gypsum board shaft wall assemblies.
- H. Cant Panels: At projections into shaft exceeding 4 inches, install 1/2- or 5/8-inch- thick gypsum board cants covering tops of projections.
 - 1. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 inches o.c. with screws fastened to shaft wall framing.
 - 2. Where steel framing is required to support gypsum board cants, install framing at 24 inches o.c. and extend studs from the projection to shaft wall framing.
- I. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.4 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and 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 09 21 16.23

SECTION 09 22 16 - 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.
 - 2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.
- B. Related Requirements:
 - 1. Section 05 40 00 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 FRAMING SYSTEMS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. 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: Coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.
- C. Studs and Runners: ASTM C 645.
 - 1. Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: 0.033 inch.
 - 1) Gauge Equivalent framing must meet or exceed the minimum performance requirements of conventional framing as defined by ASTM and AISI.
 - b. Depth: As indicated on Drawings.
- D. Slip-Type Head Joints: Where indicated, provide one of the following:
 - 1. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
 - 2. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Dietrich Metal Framing; SLP-TRK Slotted Deflection Track.
 - 2) MBA Building Supplies; Slotted Deflecto Track.
 - 3) Steel Network Inc. (The); VertiClip SLD Series.
 - 4) Superior Metal Trim; Superior Flex Track System (SFT).
 - 5) Telling Industries; Vertical Slip Track.
- E. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fire Trak Corp.; Fire Trak System attached to studs with Fire Trak Posi Klip.
 - b. Grace Construction Products; FlameSafe FlowTrak System.
 - c. Metal-Lite, Inc.; The System.

- F. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 - 1. Minimum Base-Metal Thickness: 0.033 inch.
- G. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch- wide flanges.
 - 1. Depth: 1-1/2 inches.
 - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.
- H. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 - 1. Minimum Base-Metal Thickness: 0.033 inch.
 - 2. Depth: As indicated on Drawings.
- I. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
 - 1. Configuration: Asymmetrical.
- J. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges.
 - 1. Depth: As indicated on Drawings.
 - 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch.
 - 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
- K. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.018 inch, and depth required to fit insulation thickness indicated.

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
- B. Hanger Attachments to Concrete:
 - 1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
 - a. Type: Postinstalled, expansion anchor.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch and minimum 1/2-inch- wide flanges.
 - 1. Depth: 2-1/2 inches.
- E. Furring Channels (Furring Members):
 - 1. Cold-Rolled Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
 - 2. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
 - a. Minimum Base-Metal Thickness: 0.033 inch.
 - 3. Resilient Furring Channels: 1/2-inch- deep members designed to reduce sound transmission.
 - a. Configuration: Asymmetrical.
- F. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
 - b. Chicago Metallic Corporation; Drywall Grid System.
 - c. USG Corporation; Drywall Suspension System.

2.4 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.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
 - 1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
 - 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

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.
- B. Coordination with Sprayed Fire-Resistive Materials:
 - 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
 - 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

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.
 - 2. Tile Backing Panel Assemblies: Also comply with requirements in latest version of "TCNA Handbook for Ceramic, Glass, and Stone Tile 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 o.c. unless otherwise indicated or required by referenced installation standards.
 - 2. Multilayer Application: 16 inches o.c. unless otherwise indicated or required by referenced installation standards.
 - 3. Tile Backing Panels: [16 inches] o.c. unless otherwise indicated or required by referenced installation standards.
- 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. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - 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.
 - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
 - 6. Curved Partitions:
 - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
 - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.
- 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 o.c.
- F. Z-Furring Members:
 - 1. Erect insulation, specified in Section 07 21 00 "Thermal Insulation," vertically and hold in place with Z-furring members spaced 24 inches o.c.
 - 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
 - 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
- G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Hangers: 48 inches o.c. or as required by referenced installation standards
 - 2. Carrying Channels (Main Runners): 48 inches o.c. or as required by referenced installation standards.
 - 3. Furring Channels (Furring Members): 16 inches o.c. or as required by referenced installation standards.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 - 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 4. Hangers may be attached to steel roof deck, with limitations on spacing and weight as indicated on Drawings.
 - 5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 - 6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 - 7. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

- G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 22 16

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

- 1. Interior gypsum board.
- 2. Tile backing panels.

B. Related Requirements:

- 1. Section 06 16 00 "Sheathing" for gypsum sheathing for exterior walls.
- 2. Section 09 22 16 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.
- 3. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:

- 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
- 2. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project, cost for each regional material, and fraction by weight that is considered regional.
- 3. Product Data for Credit IEQ 4.1: For adhesives used to laminate gypsum board panels to substrates, documentation including printed statement of VOC content.

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 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

- A. Recycled Content of Gypsum Panel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.
- B. Regional Materials: Gypsum panel products shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- C. Regional Materials: Gypsum panel products shall be manufactured within 500 miles of Project site.
- D. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

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

2. CertainTeed Corp.
 3. Georgia-Pacific Gypsum LLC.
 4. Lafarge North America Inc.
 5. National Gypsum Company.
 6. PABCO Gypsum.
 7. Temple-Inland.
 8. USG Corporation.
- B. Gypsum Board, Type X: ASTM C 1396/C 1396M.
1. Thickness: 5/8 inch.
 2. Long Edges: Tapered.
- C. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
1. Thickness: 1/2 inch.
 2. Long Edges: Tapered.
- D. 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, Type X.
 2. Long Edges: Tapered.
 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. C-Cure; C-Cure Board 990.
 - b. CertainTeed Corp.; FiberCement BackerBoard.
 - c. Custom Building Products; Wonderboard.
 - d. FinPan, Inc.; ProTEC.
 - e. James Hardie Building Products, Inc.; Hardiebacker 500.
 - f. National Gypsum Company, Permabase Cement Board.
 - g. USG Corporation; DUROCK Cement Board.
 - h. .
 2. Thickness: 1/2 inch.
 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.5 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.

2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. Expansion (control) joint.

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

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fry Reglet Corp.
 - b. Gordon, Inc.
 - c. Pittcon Industries.
2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
3. Finish: Class II anodic finish.

2.6 JOINT TREATMENT MATERIALS

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

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

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

1. Prefilling: At open joints 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.
5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

D. Joint Compound for Tile Backing Panels:

1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.7 AUXILIARY MATERIALS

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

- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
 - 1. Laminating adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
 - 2. Recycled Content of Blankets: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- E. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
 - b. Grabber Construction Products; Acoustical Sealant GSC.
 - c. Pecora Corporation; AC-20 FTR.
 - d. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
 - e. USG Corporation; SHEETROCK Acoustical Sealant.
 - 2. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. Thermal Insulation: As specified in Section 07 21 00 "Thermal Insulation."
- G. Vapor Retarder: As specified in Section 07 21 00 "Thermal Insulation."

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 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. 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- 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- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Type X: Vertical surfaces unless otherwise indicated.
 - 2. Ceiling Type: Ceiling surfaces.
 - 3. Moisture- and Mold-Resistant Type:
 - a. Vertical surfaces with wall-mounted plumbing fixtures not scheduled to receive tile finish. Provide panels full height of wall, and extend minimum 3 feet on each side from edge of fixture.
 - b. Vertical surfaces scheduled to receive FRP panel finish.
 - c. Ceiling surfaces over single user shower and/or tub areas.
- 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.
- C. Multilayer Application:
 - 1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
 - 2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
 - 3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
 - 4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

- D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.
- E. Curved Surfaces:
 - 1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- long straight sections at ends of curves and tangent to them.
 - 2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.4 APPLYING TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.
- B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners unless otherwise indicated.
 - 2. LC-Bead: Use at exposed panel edges.
- D. Aluminum Trim: Install in locations indicated on Drawings.

3.6 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints 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 2: Panels that are substrate for tile.
 3. Level 3: At panel surfaces that will receive wall coverings.
 - a. Writable wall coverings shall have a level 5 finish.
 4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in other Section 09 91 23 "Interior Painting."
 5. Level 5: At panel surfaces that will be exposed to view with gloss and semigloss paint finishes.
 - a. Primer and its application to surfaces are specified in other Section 09 91 23 "Interior Painting."
- E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 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 09 29 00

SECTION 09 30 00 - TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Ceramic tile.
 - 2. Metal edge strips.
- B. Related Sections:
 - 1. Section 07 92 00 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
 - 2. Section 09 29 00 "Gypsum Board" for cementitious backer units.

1.3 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."
- C. Module Size: Actual tile size plus joint width indicated.
- D. Face Size: Actual tile size, excluding spacer lugs.

1.4 PERFORMANCE REQUIREMENTS

- A. Dynamic Coefficient of Friction (DCOF): For tile installed on walkway surfaces, provide products with a minimum threshold of 0.42 as determined by testing identical products using a BOT 3000 device per ANSI A137.1.

1.5 ACTION SUBMITTALS

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

1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.
 2. Product Data for Credit IEQ 4.3: For adhesives and grouts, documentation including printed statement of VOC content.
 3. Product Data for Credit IEQ 4.3: For tile floors, documentation from an independent testing agency indicating compliance with the FloorScore Standard.
- C. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- D. Samples for Verification:
1. Full-size units of each type and composition of tile and for each color and finish required.
 2. Metal edge strips in 6-inch lengths.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
 2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.7 QUALITY ASSURANCE

- A. Source Limitations for Tile: Obtain tile of each type and color or finish from one source or producer.
1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
1. Joint sealants.
 2. Metal edge strips.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.
- E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.
- C. FloorScore Compliance: Tile for floors shall comply with requirements of FloorScore Standard.
- D. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- E. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
 - 1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

- F. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.2 TILE PRODUCTS

A. Products:

1. WT-1: Crossville; Glassbox G039, size: 1x1, color: Amethyst.
2. WT-2: Crossville; Color Box, size: 18x18, color: Sandbox.
3. WT-3: Crossville; Color Box, size: 18x18, color: Roasted Marshmallow.
4. T-1: Crossville; Color Box, size: 18x18, color: I See The Moon.

B. Product Contacts:

1. Crossville Tile: Randi Carletti; 630-818-7849, CarlettiR@virginiatile.com

2.3 SETTING MATERIALS

A. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.

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. Bostik, Inc.
 - b. MAPEI Corporation.
 - c. TEC; a subsidiary of H. B. Fuller Company.
2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

B. Medium-Bed, Latex-Portland Cement Mortar: Comply with requirements in ANSI A118.4. Provide product that is approved by manufacturer for application thickness of 5/8 inch.

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. Bostik, Inc.
 - b. MAPEI Corporation.
 - c. TEC; a subsidiary of H. B. Fuller Company.
2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.

2.4 GROUT MATERIALS

- A. Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D.
 - 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. Bostik, Inc.
 - b. MAPEI Corporation.
 - c. TEC; a subsidiary of H. B. Fuller Company.
 - 2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 deg F and 212 deg F, respectively, and certified by manufacturer for intended use.
 - 3. Provide 100% solids epoxy.

2.5 ELASTOMERIC SEALANTS

- A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Section 07 92 00 "Joint Sealants."
 - 1. Sealants shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.
- B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.
- C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. DAP Inc.; 100 percent Silicone Kitchen and Bath Sealant.
 - b. Dow Corning Corporation; Dow Corning 786.
 - c. GE Silicones; a division of GE Specialty Materials; Sanitary 1700.
 - d. Laticrete International, Inc.; Latasil Tile & Stone Sealant.
 - e. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
 - f. Tremco Incorporated; Tremsil 600 White.

2.6 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Metal Edge Strips:

1. At inside corners: Schluter Dilex-EKE.
 2. At outside corners: Schluter Jolly.
- C. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F per ASTM D 87.
 2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.
- D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.7 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 2. Verify that concrete substrates for tile floors installed with thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been

- completed.
- 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.
- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
- D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 TILE INSTALLATION

- A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
 - 1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:
 - a. Tile floors in wet areas.
 - b. Tile floors composed of tiles 8 by 8 inches or larger.
 - c. Tile floors composed of rib-backed tiles.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

- E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 - 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - 3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
 - 1. Ceramic Mosaic Tile: 1/8 inch.
- G. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- H. Metal Edge Strips: Install at locations indicated.

3.4 CLEANING AND PROTECTING

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove epoxy grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
 - 3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.
- B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.5 INTERIOR TILE INSTALLATION SCHEDULE

- A. Interior Floor Installations, Concrete Subfloor:
 - 1. Tile Installation F115: Thin-set mortar; epoxy grout; TCA F115.
 - a. Thin-Set Mortar: Medium-bed, latex- portland cement mortar.
 - b. Grout: Water-cleanable epoxy grout.

- B. Interior Wall Installations, Masonry or Concrete:
 - 1. Tile Installation W202: Thin-set mortar; TCA W202.
 - a. Thin-Set Mortar: Latex- portland cement mortar.
 - b. Grout: Water-cleanable epoxy grout.

- C. Interior Wall Installations, Metal Studs or Furring:
 - 1. Tile Installation W244: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCA W244.
 - a. Thin-Set Mortar: Latex- portland cement mortar.
 - b. Grout: Water-cleanable epoxy grout.

END OF SECTION 09 30 00

SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes acoustical panels and exposed suspension systems for ceilings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
 - 2. Product Data for Credit EQ 4.1: For sealants, documentation including printed statement of VOC content.
- C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
 - 1. Acoustical Panel: Set of 6-inch- square Samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- long Samples of each type, finish, and color.

1.4 CLOSEOUT SUBMITTALS

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

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.
 - 2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
 - 2. Smoke-Developed Index: 50 or less.
- C. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.2 ACOUSTICAL PANELS, GENERAL

- A. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.
- B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.3 ACOUSTICAL PANELS

- A. Ceiling Type 4:
 - 1. Manufacturers:

- a. Armstrong World Industries, Inc.; Dune.
 - b. CertainTeed Corp.; Cashmere.
 - c. USG Interiors, Inc.; Astro ClimaPlus.
 - 2. Modular Size: 24 inches by 24 inches by 5/8 inches, square lay-in edge.
 - 3. Color: White.
- B. Ceiling Type 5:
 - 1. Manufacturers:
 - a. Armstrong World Industries, Inc.; Ultima Health Zone.
 - b. CertainTeed Corp.; Vinylshield A.
 - c. USG Interiors, Inc.; Clean Room ClimaPlus (unperforated.)
 - 2. Modular Size: 24 inches by 24 inches, square lay-in edge.
 - 3. Color: White.
- C. Ceiling Type 6:
 - 1. Manufacturers:
 - a. Armstrong World Industries, Inc.; Cirrus Second Look III 514 with beveled tegular edge.
 - b. CertainTeed Corp.; Cashmere Customline 448 with reveal corner bead.
 - c. USG Interiors, Inc.; Eclipse ClimaPlus Illusions 4/48 78711 with Shadowline tapered edge.
- D. Product Contacts:
 - 1. Armstrong: Tabitha Ruiz, 312-282-0759, TSRuiz@armstrong.com
 - 2. CertainTeed: Demetrius Damaskos
 - 3. USG: Miya Russell, 312-519-9447, MRussell@usg.com

2.4 METAL SUSPENSION SYSTEMS, GENERAL

- A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.
- C. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
 - 1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

- a. Type: Postinstalled expansion anchors.
 - b. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
- D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - 2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.135-inch- diameter wire.
- E. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
- F. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

2.5 METAL SUSPENSION SYSTEM

- A. Ceiling Types 4, 5, and 6:
 - 1. Manufacturers:
 - a. Armstrong World Industries, Inc.; Prelude XL HRC 15/16".
 - b. CertainTeed Corp., 15/16" Classic Stab System.
 - c. USG Interiors, Inc.; DONN DX 15/16".
 - 2. Structural Classification: Intermediate Duty.
 - 3. Color: White.

2.6 METAL EDGE MOLDINGS AND TRIM

- A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
 - 1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
 - 2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
 - 3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
- B. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and

other clips, complying with seismic design requirements and the following:

1. Provide 2, 4, and 6 inch perimeter edge trim units where indicated on Drawings.
2. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils. Comply with ASTM C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.7 ACOUSTICAL SEALANT

- A. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
1. Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant.
 2. Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant.
 3. Acoustical sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
1. Install hangers plumb and free from contact with insulation or other objects within

- ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 7. Do not attach hangers to steel deck tabs.
 8. Hangers may be attached to steel deck, with limitations on spacing and weight as indicated on Drawings.
 9. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
 2. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.

3. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
4. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
5. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 CLEANING

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

END OF SECTION 09 51 13

SECTION 09 64 66 - WOOD ATHLETIC FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes wood athletic flooring.

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 for wood athletic flooring.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For adhesives, documentation including printed statement of VOC content.
 - 2. Product Data for Credit IEQ 4.2: For field-applied finishes and game-line and marker paints, documentation including printed statement of VOC content.
 - 3. Product Data for Credit IEQ 4.3: For adhesives and field-applied finishes and game-line and marker paints, documentation including printed statement of VOC content.
 - 4. Product Data for Credit IEQ 4.3: For wood athletic flooring, documentation from an independent testing agency indicating compliance with the FloorScore Standard.
- C. Shop Drawings: For each type of floor assembly and accessory. Include plans, elevations, sections, details, and attachments to other work. Include the following:
 - 1. Expansion provisions and trim details.
 - 2. Layout, colors, widths, and dimensions of game lines and markers.
 - 3. Locations of floor inserts for athletic equipment installed through flooring assembly.
- D. Samples for Initial Selection: Manufacturer's color charts showing colors and glosses available for the following:
 - 1. Game-line and marker paint.
 - 2. Color samples for protective floor cover.
 - 3. Vented base.
- E. Samples for Verification: For each type of wood athletic flooring and accessory required; approximately 12 inches long and of same thickness and material indicated for the Work.

1. Include sample sets showing the full range of normal color and texture variations expected in wood flooring.
2. Include Sample sets showing finishes and game-line and marker paint colors applied to wood flooring.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For wood athletic flooring and finish systems to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual that has been approved by MFMA as an accredited Installer according to the MFMA Accreditation Program.
- B. Maple Flooring: Comply with MFMA grading rules for species, grade, and cut.
 1. Certification: Provide flooring that carries MFMA mark on each bundle or piece.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver assembly materials in unopened cartons or bundles.
- B. Protect wood from exposure to moisture. Do not deliver wood components until after concrete, masonry, plaster, ceramic tile, and similar wet work is complete and dry.
- C. Store wood components in a dry, warm, well-ventilated, weathertight location and in a horizontal position.

1.7 FIELD CONDITIONS

- A. Conditioning period begins not less than seven days before wood athletic flooring installation, is continuous through installation, and continues not less than seven days after installation.
 1. Environmental Conditioning: Maintain an ambient temperature between 65 and 75 deg F and relative humidity planned for building occupants, but not less than 35 percent or more than 50 percent, in spaces to receive wood athletic flooring during the conditioning period.
 2. Wood Conditioning: Move wood components into spaces where they will be installed, no later than beginning of the conditioning period.
 - a. Do not install wood athletic flooring until wood components adjust to relative humidity of, and are at same temperature as, spaces where they are to be installed.
 - b. Open sealed packages to allow wood components to acclimatize immediately on moving wood components into spaces in which they will be installed.

- B. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.
- C. Install wood athletic flooring after other finishing operations, including painting, have been completed.

1.8 COORDINATION

- A. Coordinate with concrete subfloor installer the requirements for flatness and levelness, and for recess depth so that the top of wood athletic flooring aligns with the top of the adjacent sports rubber flooring.
- B. Coordinate layout and installation of wood athletic flooring systems with floor inserts for gymnasium equipment.

PART 2 - PRODUCTS

2.1 WOOD ATHLETIC FLOORING

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Connor Sports Flooring; Rezill Channel-01, or one of the following products:
 - 1. Acer Flooring, LLC.; Acer Channel VLP-HC.
 - 2. Action Floor Systems, LLC.; Anchor Flex.
 - 3. Horner Flooring Company, Inc.; CRP System.
 - 4. Robbins Sports Surfaces; Bio-Channel Classic, with isolation kerfs.
- B. System Description:
 - 1. System Type: Fixed.
 - 2. Flooring: Northern Hard Maple, Grades 2 and 3 where indicated on Drawings; 25/32 inch thickness by 2-1/4 inch width.

2.2 PERFORMANCE REQUIREMENTS

- A. Provide wood athletic flooring systems tested by a qualified testing agency according to DIN V 18032-2 and shown to meet the following requirements:
 - 1. Shock Absorption: Minimum 53 percent.
 - 2. Vertical Deflection: Minimum 0.09 inch.
 - 3. Area of Deflection: Maximum 15 percent.
 - 4. Ball Bounce: Minimum 90 percent.
 - 5. Surface Friction: Not less than 0.5 or more than 0.7.
 - 6. Rolling Loads: No damage when subjected to 337 lbf applied through a single wheel.
- B. FloorScore Compliance: Wood athletic flooring shall comply with requirements of FloorScore Standard.

2.3 FINISHES

- A. Floor-Finish System: System of compatible components recommended in writing by flooring manufacturer, and MFMA approved.
 - 1. Floor-Sealer Formulation: Pliable, penetrating type. MFMA Group 1, Sealers.
 - 2. Finish-Coat Formulation: Formulated for gloss finish indicated and multicoat application.
 - a. Type: MFMA Group 3, Gymnasium-Type Surface Finishes.
 - 3. Game-Line and Marker Paint: Industrial enamel compatible with finish coats and recommended in writing by manufacturers of finish coats, and paint for this use.
 - 4. VOC Content: Products shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Floor Sealers and Finish Coats: VOC content of not more than 350 g/L.
 - b. Game-Line and Marker Paint: VOC content of not more than 150 g/L.

2.4 ACCESSORIES

- A. Vapor Retarder: ASTM D 4397, polyethylene sheet not less than 6 mils thick.
- B. Resilient Wall Base: Molded, vented, rubber or vinyl cove base; 4 by 3 by 48 inches; with premolded outside corners.
 - 1. Color: Black.
- C. Thresholds: As specified in Section 08 71 00 "Door Hardware."
- D. Fasteners: Type and size recommended by manufacturer, but not less than those recommended by MFMA for application indicated.
- E. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by wood athletic flooring manufacturer.
- F. Adhesives: Manufacturer's standard for application indicated that has a VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- G. Adhesives: Manufacturer's standard for application indicated that comply 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."
- H. Protective Floor Cover: Provide manufacturer's protective floor cover sheet and associated mobile storage cart with power winder, brush assembly, and storage cover.
 - 1. Basis-of-Design: Connor Sports Flooring; CourtCover Light. Color to be selected from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of wood athletic flooring.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Concrete Slabs: Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
 - 1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than two tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Perform anhydrous calcium chloride test per ASTM F 1869, as follows:
 - 1) Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

3.2 PREPARATION

- A. Grind high spots and fill low spots on concrete substrates to produce a maximum 1/8-inch deviation in any direction when checked with a 10-foot straight edge.
 - 1. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
- B. Remove coatings including curing compounds and other substances on substrates that are incompatible with installation adhesives and that contain soap, wax, oil, or silicone; use mechanical methods recommended by manufacturer. Do not use solvents.
- C. Broom and vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. General: Comply with wood athletic flooring manufacturer's written instructions, but not less than written recommendations of MFMA applicable to flooring type indicated.
- B. Pattern: Lay flooring with planks running in the east-west direction.
- C. Expansion Spaces: Provide as indicated, but not less than that required by manufacturer's written instructions and MFMA's written recommendations at walls and other obstructions, and at interruptions and terminations of flooring.

1. Cover expansion spaces with base molding, trim, and saddles, as indicated on Drawings.
- D. Vapor Retarder: Cover entire slab area beneath wood flooring. Install with joints lapped a minimum of 6 inches and sealed.
- E. Underlayment: Install perpendicular to direction of flooring, staggering end joints in adjacent rows.
- F. Channels: Anchor channels to substrate according to manufacturer's written instructions.
 1. Install wood strip flooring across channels.
 2. Insert steel clip at each intersection of a flooring strip with a channel.
- G. Strip Flooring: Mechanically fasten perpendicular to supports.
- H. Installation Tolerances: 1/8 inch in 10 feet of variance from level.

3.4 SANDING AND FINISHING

- A. Allow installed flooring to acclimate to ambient conditions before sanding.
- B. Follow applicable recommendations in MFMA's "Industry Recommendations for Sanding, Sealing, Court Lining, Finishing, and Resurfacing of Maple Gym Floors."
- C. Machine sand with coarse, medium, and fine grades of sandpaper to achieve a level, smooth, uniform surface without ridges or cups. Remove sanding dust by tack or vacuum.
- D. Finish: Apply seal and finish coats of finish system according to finish manufacturer's written instructions. Provide no fewer than four coats total and no fewer than two finish coats.
 1. Water-Based Finishes: Use finishing methods recommended by finish manufacturer to reduce grain raise and sidebonding effect.
 2. Game-Line and Marker Paint: Apply game-line and marker paint between final seal coat and first finish coat according to paint manufacturer's written instructions.
 - a. Mask flooring at game lines and markers, and apply paint to produce lines and markers with sharp edges.
 - b. Where game lines cross, break minor game line at intersection; do not overlap lines.
 - c. Apply game lines and markers in widths and colors according to NJCAA requirements for the sport indicated .
 - d. Apply finish coats after game-line and marker paint is fully cured.

3.5 PROTECTION

- A. Protect wood athletic flooring during remainder of construction period to allow finish to cure and to ensure that flooring and finish are without damage or deterioration at time of Substantial Completion.
 - 1. Do not cover flooring after finishing until finish reaches full cure and not before seven days after applying last finish coat.
 - 2. Do not move heavy and sharp objects directly over flooring. Protect fully cured floor finishes and surfaces with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 09 64 66

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Resilient base.
2. Resilient stair accessories.
3. Floor transitions, metal.

B. Related Sections:

1. Section 09 65 16 "Resilient Sheet Flooring" for resilient sheet floor coverings.
2. Section 09 65 19 "Resilient Tile Flooring" for resilient floor tile.
3. Section 09 65 66 "Resilient Athletic Flooring" for resilient floor coverings for use in athletic-activity or support areas.

1.3 ACTION SUBMITTALS

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

- B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For adhesives, documentation including printed statement of VOC content.

- C. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches long, of each resilient product color, texture, and pattern required.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing identical products

according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.7 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:
 1. 48 hours before installation.
 2. During installation.
 3. 48 hours after installation.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Source Limitations:
 1. Resilient Base, Resilient Stair Accessories, and Resilient Tile Flooring for stair landings (specified in Section 09 65 19): Obtain each type from single source from single manufacturer.
- B. Product Contacts:
 1. Johnsonite: Ivana Rosich, 773-318-0630, Ivana.Rosich@johnsonite.com
 2. Roppe: Joseph Tuffner, 630-947-2803, jmtuffner@roppe.com

2.2 RESILIENT BASE

- A. Resilient Base:
 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. Johnsonite.

- b. Roppe Corporation, USA.
- c. VPI, LLC; Floor Products Division.

2. Basis-of-Design:

- a. RB-1: Johnsonite; 4" Straight, Black.
- b. RB-2: Roppe Corp.; 4" Coved, Smoke 174.
- c. RB-3: Johnsonite; 1/2" Quarter Round, Black.
- d. RB-4: Johnsonite; 4" Coved, Grapest TB4.
- e. RB-5: Johnsonite; 4" Coved, Black.
- f. RB-6 Johnsonite; 6" Coved, Black.

B. Resilient Base Standard: ASTM F 1861.

- 1. Material Requirement: Type TS (rubber, vulcanized thermoset).
- 2. Manufacturing Method: Group I (solid, homogeneous).

C. Minimum Thickness: 0.125 inch.

D. Height: 4 inches.

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Job formed.

G. Inside Corners: Job formed.

H. Finish: Low luster.

2.3 RESILIENT STAIR ACCESSORIES

A. Resilient Stair Treads:

- 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. Johnsonite.
- b. Roppe Corporation, USA.
- c. VPI, LLC; Floor Products Division.

2. Basis-of-Design:

- a. RST-1: Johnsonite; SafeTcork Stair Tread, hammered texture with detectable warning strip at nosing; Z100 Black. Nosing color to be selected from manufacturer's full range.

B. Nosing Style: Square, adjustable to cover angles between 60 and 90 degrees.

C. Size: Lengths and depths to fit each stair tread in one piece or, for treads exceeding maximum lengths manufactured, in equal-length units.

D. Risers: Smooth, flat, toeless, height and length to cover risers; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.

1. Thickness: 0.080 inch.

2.4 FLOOR TRANSITIONS, METAL

- A. Basis-of-Design: Flooring Transition Strips, metal:
 1. TRANS-01: Schluter; Reno-Ramp AERP 60 B50; 1/4" to 0".
 2. TRANS-02: Schluter; Scheine AE60; 1/4" to 1/8".
 3. TRANS-03: Blanke; Reducer Trim 217-410-12525; 1/2" to 1/8".
 4. TRANS-04: Gradus; Feather Edge TA25; 1/8" to 0".
 5. TRANS-05: Schluter; Scheine AE30; 1/8" to 1/8".
 6. TRANS-06: Schluter; Reno-Ramp AERP 100 B65; 10mm to 0".

2.5 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
 1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24)[, except that adhesive for rubber stair treads shall have a VOC content of 60 g/L or less].
- C. Stair-Tread-Nose Filler: Two-part epoxy compound recommended by resilient tread manufacturer to fill nosing substrates that do not conform to tread contours.
- D. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Stair Treads and Accessories: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
 - 4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient products until they are same temperature as the space where they are to be installed.
 - 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- H. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Stair Accessories:
 1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
 2. Tightly adhere to substrates throughout length of each piece.
 3. For treads installed as separate, equal-length units, install to produce a flush joint between units.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Perform the following operations immediately after completing resilient product installation:
 1. Remove adhesive and other blemishes from exposed surfaces.
 2. Sweep and vacuum surfaces thoroughly.
 3. Damp-mop surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products until Substantial Completion.

END OF SECTION 09 65 13

SECTION 09 65 16 - RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Vinyl sheet floor covering, with without backing.

- B. Related Sections:

- 1. Section 09 65 13 "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.
- 2. Section 09 65 19 "Resilient Tile Flooring" for resilient floor tile.
- 3. Section 09 65 66 "Resilient Athletic Flooring" for resilient floor coverings for use in athletic-activity or support areas.

1.3 ACTION SUBMITTALS

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

- B. LEED Submittals:

- 1. Product Data for Credit IEQ 4.1: For , documentation including printed statement of VOC content.
- 2. Product Data for Credit IEQ 4.3: For adhesives [and chemical-bonding compounds], documentation including printed statement of VOC content.
- 3. Product Data for Credit IEQ 4.3: For resilient sheet flooring, documentation from an independent testing agency indicating compliance with the FloorScore Standard.

- C. Shop Drawings: For each type of floor covering. Include floor covering layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

- 1. Show details of special patterns.

- D. Samples for Verification: In manufacturer's standard size, but not less than 6-by-9-inch sections of each different color and pattern of floor covering required.

- E. Seam Samples: For seamless-installation technique indicated and for each floor covering product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to a rigid backing and prepared by Installer for this Project.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor covering to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Floor Covering: Furnish quantity not less than 10 linear feet for every 500 linear feet or fraction thereof, in roll form and in full roll width for each color, pattern, and type of floor covering installed.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor covering installation and seaming method indicated.
 - 1. Engage an installer who employs workers for this Project who are trained or certified by floor covering manufacturer for installation techniques required.
- B. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store floor coverings and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store rolls upright.

1.9 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F, in spaces to receive floor coverings during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.

- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during floor covering installation.
- D. Close spaces to traffic for 48 hours after floor covering installation.
- E. Install floor coverings after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. FloorScore Compliance: Resilient sheet flooring shall comply with requirements of FloorScore Standard.
- B. Low-Emitting Materials: Flooring system shall comply 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 VINYL SHEET FLOOR COVERING

- A. Products:
 - 1. SV-1: Altro; Walkway 20, color: VMI 2058 Cool.
 - 2. SV-2: Altro; Walkway 20, color: VMI 2055 Blizzard.
 - 3. SVC-1: Altro; 4" flash cove base with cove stick and cove cap; Walkway 20, color: VMI 2058 Cool.
 - 4. SVC-2: Altro; 4" flash cove base with cove stick and cove cap; Walkway 20, color: VMI 2055 Blizzard.
- B. Product Contact:
 - 1. Altro: Carola Klein, 312-898-0745, CKlein@altro.com
- C. Seaming Method: Heat welded.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit floor covering and substrate conditions indicated.
 - 1. Adhesives shall have a VOC content of not more than 50 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Adhesives shall comply 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."
- C. Seamless-Installation Accessories:
1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.
 - a. Color: Match floor covering.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor coverings.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of floor coverings.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
 4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor coverings until they are same temperature as space where they are to be installed.

1. Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- E. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation.

3.3 FLOOR COVERING INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor coverings.
- B. Unroll floor coverings and allow them to stabilize before cutting and fitting.
- C. Lay out floor coverings as follows:
1. Maintain uniformity of floor covering direction.
 2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in floor covering substrates.
 3. Match edges of floor coverings for color shading at seams.
 4. Avoid cross seams.
- D. Scribe and cut floor coverings to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, and door frames.
- E. Extend floor coverings into toe spaces, door reveals, closets, and similar openings.
- F. Maintain reference markers, holes, or openings that are in place or marked for future cutting by repeating on floor coverings as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install floor coverings on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of floor coverings installed on covers and adjoining floor covering. Tightly adhere floor covering edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor coverings to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- I. Seamless Installation:
1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and use welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces.
- J. Integral-Flash-Cove Base: Cove floor coverings dimension indicated up vertical surfaces. Support floor coverings at horizontal and vertical junction by cove strip. Butt at top against cap strip.
1. Install metal corners at inside and outside corners.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of floor coverings.
- B. Perform the following operations immediately after completing floor covering installation:
 - 1. Remove adhesive and other blemishes from floor covering surfaces.
 - 2. Sweep and vacuum floor coverings thoroughly.
 - 3. Damp-mop floor coverings to remove marks and soil.
- C. Protect floor coverings from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover floor coverings until Substantial Completion.

END OF SECTION 09 65 16

SECTION 09 65 19 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Rubber floor tile.
 - 2. Vinyl composition floor tile.
- B. Related Sections:
 - 1. Section 09 65 13 "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.
 - 2. Section 096516 "Resilient Sheet Flooring" for resilient sheet floor coverings.
 - 3. Section 096566 "Resilient Athletic Flooring" for resilient floor coverings for use in athletic-activity or support areas.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For adhesives, sealants and chemical-bonding compounds, documentation including printed statement of VOC content.
 - 2. Product Data for Credit IEQ 4.3: For adhesives [and chemical-bonding compounds], documentation including printed statement of VOC content.
 - 3. Product Data for Credit IEQ 4.3: For resilient tile flooring, documentation from an independent testing agency indicating compliance with the FloorScore Standard.
- C. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - 1. Show details of special patterns.
- D. Samples for Verification: Full-size units of each color and pattern of floor tile required.
- E. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.5 MATERIALS MAINTENANCE SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
 - 1. Engage an installer who employs workers for this Project who are trained or certified by manufacturer for installation techniques required.
- B. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.8 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:
 - 1. 72 hours before installation.
 - 2. During installation.
 - 3. 72 hours after installation.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 72 hours after floor tile installation.

- E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 GENERAL

A. Source Limitations:

- 1. Resilient Tile Flooring for stair landings, and Resilient Base and Resilient Stair Accessories (specified in Section 09 65 13): Obtain each type from single source from single manufacturer.

B. Product Contacts:

- 1. Armstrong: Bridgette O'Connor, 815-219-8111, BOconnor@florstar.com
- 2. Roppe: Joseph Tuffner, 630-947-2803, jmtuffner@roppe.com.

2.2 PERFORMANCE REQUIREMENTS

- A. FloorScore Compliance: Resilient tile flooring shall comply with requirements of FloorScore Standard.

2.3 RUBBER FLOOR TILE

A. Products:

- 1. RT-1: Roppe; SafeTcork Rubber Tile 995 with hammered texture, size: 19.5 by 19.5 inches, color: Z100 Black.
- 2. DWT-1: Roppe; SafeTcork Warning Tile 953, size: 24 by 24 inches, color Z100 Black.

2.4 VINYL COMPOSITION FLOOR TILE

A. Products:

- 1. VCT-1: Armstrong: Migrations, size: 12x12, color: Glacier Gray T3506.
- 2. VCT-2: Armstrong: Migrations, size: 12x12, color: Basalt Black T3500, random pattern.
- 3. VCT-3: Armstrong: Migrations, size: 12x12, color: Violet Grape T3625, random pattern.
- 4. VCT-4: Armstrong: Migrations, size: 12x12, color: Ice White T3504, random pattern.
- 5. VCT-5: Armstrong: Raffia, size: 12x24, color: Golden Blossom 55807, brick pattern.

2.5 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated.
 - 1. Adhesives shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. VCT and Asphalt Tile Adhesives: Not more than 50 g/L.
 - b. Rubber Floor Adhesives: Not more than 60 g/L.
- C. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
 - 4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-

emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until they are same temperature as space where they are to be installed.
 - 1. Move resilient products and installation materials into spaces where they will be installed at least 72 hours in advance of installation.
- E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles square with room axis .
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 - 1. Lay tiles with grain direction alternating in adjacent tiles (basket-weave pattern).
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
- G. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.

3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor tile surfaces before applying liquid floor polish.
 1. Apply number of coats recommended by manufacturer.
- E. Cover floor tile until Substantial Completion.

END OF SECTION 09 65 19

SECTION 09 65 66 - RESILIENT ATHLETIC FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Rubber sheet flooring.
- B. Related Sections:
 - 1. Section 09 64 66 "Wood Athletic Flooring" for resilient wood flooring.
 - 2. Section 09 65 13 "Resilient Base and Accessories" for wall base and accessories installed with flooring.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
 - 2. Product Data for Credit IEQ 4.1: For adhesives, documentation including printed statement of VOC content.
 - 3. Product Data for Credit IEQ 4.2: For game-line and marker paints, documentation including printed statement of VOC content.
 - 4. Product Data for Credit IEQ 4.3: For adhesives [and game-line and marker paints], documentation including printed statement of VOC content.
 - 5. Product Data for Credit IEQ 4.3: For resilient athletic flooring, documentation from an independent testing agency indicating compliance with the FloorScore Standard.
- C. Shop Drawings: Show installation details and locations of the following:
 - 1. Floor patterns.
 - 2. Layout, colors, widths, and dimensions of game lines and markers.
 - 3. Locations of floor inserts for athletic equipment installed through flooring.
 - 4. Seam locations for sheet flooring.
- D. Samples for Verification: For each type, color, and pattern of flooring indicated, 6-inch-square Samples of same thickness and material indicated for the Work.

1. Game-Line- and Marker-Paint Samples: Include Sample sets showing game-line- and marker-paint colors applied to flooring.

1.4 CLOSEOUT SUBMITTALS

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

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storing.
- B. Store materials to prevent deterioration. Store rolls upright.

1.6 FIELD CONDITIONS

- A. Adhesively Applied Products:
 1. Maintain temperatures during installation within range recommended in writing by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive flooring 48 hours before installation, during installation, and 48 hours after installation unless longer period is recommended in writing by manufacturer.
 2. After postinstallation period, maintain temperatures within range recommended in writing by manufacturer, but not less than 55 deg F or more than 95 deg F.
 3. Close spaces to traffic during flooring installation.
 4. Close spaces to traffic for 48 hours after flooring installation unless manufacturer recommends longer period in writing.
- B. Install flooring after other finishing operations, including painting, have been completed.

1.7 COORDINATION

- A. Coordinate layout and installation of flooring with floor inserts for gymnasium equipment.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Product Contacts:
 1. Mondo: Eric Kumerow, 224-321-6137, eric@keiferusa.com
 2. RB Rubber: Kelli Mildren, 630-390-5406, kmildren@ejwelch.com

2.2 PERFORMANCE REQUIREMENTS

- A. FloorScore Compliance: Resilient athletic flooring shall comply with requirements of

FloorScore Standard.

2.3 RUBBER SHEET FLOORING

A. Products:

1. SR-1: RB Rubber; 3/8" Rolled Rubber, custom color: 90% Black, 10% Light Gray.
2. SR-2: RB Rubber; 3/8" Rolled Rubber, custom color: 70% Beige, 20% Medium Brown, 10% Black.
3. SR-3: RB Rubber, 3/8" Rolled Rubber, custom color: 90% Purple, 10% Black.
4. SR-4: Mondo; Sportflex M 12mm, color: Grey.
5. SR-5: Mondo: Advance 8mm, color: L62 Sand.

B. Description: Rubber athletic flooring provided as rolled goods for adhered installation.

2.4 ACCESSORIES

A. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by flooring manufacturer.

B. Adhesives: Water-resistant type recommended in writing by manufacturer for substrate and conditions indicated.

1. Adhesives shall have a VOC content of 60 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Game-Line and Marker Paint: Complete system including primer, if any, compatible with flooring and recommended in writing by flooring and paint manufacturers for use indicated.

1. VOC Content: Not more than 150 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of flooring.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Alkalinity Testing: Perform pH testing according to ASTM F 710. Proceed with installation only if pH readings are not less than 7.0 and not greater than 8.5.
 - 3. Moisture Testing:
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - 1) Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than two tests in each installation area and with test areas evenly spaced in installation areas.
- C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by manufacturer. Do not use solvents.
- D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.
- E. Move flooring and installation materials into spaces where they will be installed at least 48 hours in advance of installation unless manufacturer recommends a longer period in writing.
 - 1. Do not install flooring until they are same temperature as space where they are to be installed.
- F. Sweep and vacuum clean substrates to be covered by flooring immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust.
- G. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 FLOORING INSTALLATION, GENERAL

- A. Comply with manufacturer's written installation instructions.
- B. Scribe, cut, and fit flooring to butt neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.
- C. Extend flooring into toe spaces, door reveals, closets, and similar openings unless otherwise indicated.
- D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating subfloor markings on flooring. Use nonpermanent, nonstaining marking device.

3.4 SHEET FLOORING INSTALLATION

- A. Unroll sheet flooring and allow it to stabilize before cutting and fitting.
- B. Lay out sheet flooring as follows:
 - 1. Maintain uniformity of flooring direction.
 - 2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
 - 3. Match edges of flooring for color shading at seams.
 - 4. Locate seams per approved Shop Drawings.
- C. Adhered Flooring: Adhere products to substrates using a full spread of adhesive applied to substrate to comply with adhesive and flooring manufacturers' written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.
 - 1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.5 GAME LINES AND MARKERS

- A. Mask flooring at game lines and markers, and apply paint to produce sharp edges. Where crossing, break minor game line at intersection; do not overlap lines.
- B. Lay out game lines and markers to comply with rules and diagrams published by National Collegiate Athletic Association (NCAA) for athletic activities indicated.

3.6 CLEANING AND PROTECTING

- A. Perform the following operations immediately after completing flooring installation:
 - 1. Remove adhesive and other blemishes from flooring surfaces.
 - 2. Sweep and vacuum flooring thoroughly.
 - 3. Damp-mop flooring to remove marks and soil after time period recommended in writing by manufacturer.
- B. Protect flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
 - 1. Do not move heavy and sharp objects directly over flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 09 65 66

SECTION 09 67 23 - RESINOUS FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. High-performance resinous flooring systems.
- B. Related Sections:
 - 1. Section 07 92 00 "Joint Sealants" for sealants installed at joints in resinous flooring systems.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.2: For liquid-applied flooring components, documentation including printed statement of VOC content.
- C. Samples for Verification: For each resinous flooring system required, 6 inches square, applied to a rigid backing by Installer for this Project.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of flooring systems required for this Project.
 - 1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
- B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single

manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

- C. Mockups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Apply full-thickness mockups on 48-inch- square floor area selected by Architect.
 - a. Include 48-inch length of integral cove base with inside and outside corner.
 - 2. Simulate finished lighting conditions for Architect's review of mockups.
 - 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.
- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
- C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin Williams Co., General Polymers; GP 3745 CR Epoxy with 5190 Non Skid Additive, and GP 37CR topcoat at integral base, or comparable product by one of, but not limited to, the following:
 - 1. BASF Construction Chemicals, Inc.; BASF Building Systems.
 - 2. Dur-A-Flex, Inc.
 - 3. Stonhard, Inc.
- B. Colors:
 - 1. EP-1: Charcoal #53.
 - 2. EP-2: Custom color to match Benjamin Moore, 2068-30 Scandinavian Blue.

C. Product Contacts:

1. Sherwin Williams, General Polymers: Sebastian Cole, 847-951-7752, swrep7777@sherwin.com

2.2 MATERIALS

- A. VOC Content of Liquid-Applied Flooring Components: Not more than 100 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

2.3 ACCESSORIES

- A. Primer: Type recommended by manufacturer for substrate and body coats indicated.
- B. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

PART 3 - EXECUTION

3.1 PREPARATION

- A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry substrate for resinous flooring application.
- B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
1. Roughen concrete substrates to level recommended by manufacturer and as follows:
 - a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
 - b. Comply with ASTM C 811 requirements unless manufacturer's written instructions are more stringent.
 2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.
 3. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application of resinous flooring only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. of slab area in 24 hours.
 4. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with

application only after substrates pass testing.

- C. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
- D. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.

3.2 APPLICATION

- A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
 - 1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
 - 2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
 - 3. At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.
- B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- C. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.
 - 1. Integral Cove Base: 4 inches high.
- D. Apply self-leveling slurry body coats in thickness indicated for flooring system.
 - 1. Broadcast aggregates at rate recommended by manufacturer and, after resin is cured, remove excess aggregates to provide surface texture indicated.
- E. Apply troweled or screeded body coats in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When cured, remove trowel marks and roughness using method recommended by manufacturer.
- F. Apply grout coat, of type recommended by resinous flooring manufacturer, to fill voids in surface of final body coat and to produce wearing surface indicated.
- G. Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer.

3.3 PROTECTION

- A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION 09 67 23

SECTION 09 68 13 - TILE CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. Modular tufted carpet tile.
 - 2. Entrance walk-off carpet tile.
- B. Related Requirements:
 - 1. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
 - 2. Include installation recommendations for each type of substrate.
- B. LEED Submittals:
 - 1. Product Data for Credit EQ 4.3:
 - a. For carpet tile, documentation indicating compliance with testing and product requirements of CRI's "Green Label Plus" program.
 - b. For installation adhesive, documentation including printed statement of VOC content.
- C. Shop Drawings: Show the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
 - 2. Carpet tile type, color, and dye lot.
 - 3. Type of subfloor.
 - 4. Type of installation.
 - 5. Pattern of installation.
 - 6. Pattern type, location, and direction.
 - 7. Pile direction.
 - 8. Type, color, and location of insets and borders.
 - 9. Type, color, and location of edge, transition, and other accessory strips.

10. Transition details to other flooring materials.

D. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd..

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.8 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.9 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, loss of face fiber, and delamination.
 - 3. Warranty Period: Lifetime from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Product Contacts:
 - 1. Forbo: Rob Grom, 847-691-7021, rob.grom@forbo.com
 - 2. Interface Flor: Paul Colando, 312-753-8830, paul.colando@interfaceflor.com

2.2 CARPET TILE

- A. Products:
 - 1. CPT-1: Interface Flor; Silver Linings SL920, size: 25cm x 1m, color: Black Line. Brick pattern.
 - 2. CPT-2: Interface Flor; Silver Linings SI910, size: 25cm x 1m, color: Charcoal. Brick pattern.
 - 3. CPT-3: Interface Flor; Cubic, size: 19.7 x 19.7 in, color: Geometry. Random pattern.
 - 4. CPT-4: Interface Flor; Monochrome, size: 19.7 x 19.7 in, color: Black. Quarter Turn pattern.
 - 5. CPT-5: Interface Flor; Tectonics, size: 19.7 x 19.7 in, color: Binary. Brick pattern.
 - 6. CPT-6: Interface Flor; On Board, size: 19.7 x 19.7 in, color: Storm. Brick pattern.
 - 7. CPT-7: Forbo; Flotex Naturals, size: 2m roll, color: Blackened Oak 010037.
 - 8. CPT-8: Interface Flor; Monochrome, size: 19.7 x 19.7 in, color: Crocus. Quarter Turn pattern.
 - 9. WLKF-1: Interface Flor; Super Flor, size: 19.7 x 19.7 in, color: Grey. Brick pattern.
 - 10. WLKF-2: Interface Flor; Flor, size: 19.7 x 19.7 in, color: Anthracite. Brick pattern.

2.3 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.
 - 1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
 - 2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet tile.
 - 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

- D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.
- C. Maintain dye lot integrity. Do not mix dye lots in same area.
- D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
- G. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
 - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 - 2. Remove yarns that protrude from carpet tile surface.
 - 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 68 13

SECTION 09 72 00 - WALL COVERINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Vinyl wall covering.
- B. Related Sections:
 - 1. Section 09 91 13 "Interior Painting" Section "" for priming wall surfaces.
 - 2. Section 10 11 00 "Visual Display Surfaces" for writable (markerboard) wallcoverings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include data on physical characteristics, durability, fade resistance, and flame-resistance characteristics.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For adhesives, documentation including printed statement of VOC content.
 - 2. Product Data for Credit IEQ 4.2: For paints and coatings, documentation including printed statement of VOC content.
- C. Shop Drawings: Show location and extent of each wall-covering type. Indicate pattern placement, seams and termination points.
- D. Samples for Verification: Full width by 36-inch- long section of wall covering.
 - 1. Sample from same print run or dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat. Mark top and face of fabric.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For wall coverings to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates according to test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Surface-Burning Characteristics: As follows, per ASTM E 84:
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 50 or less.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Lighting: Do not install wall covering until a permanent level of lighting is provided on the surfaces to receive wall covering.
- C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

PART 2 - PRODUCTS

2.1 WALL COVERINGS

- A. General: Provide rolls of each type of wall covering from same print run or dye lot.

2.2 VINYL WALL COVERING (WC-2, WC-3, WC-4, WC-5)

- A. Vinyl Wall-Covering Standards: Provide mildew-resistant products complying with the following:
 - 1. FS CCC-W-408D and CFFA-W-101-D for Type III, Heavy-Duty products.
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. API Signs, contact: Lee Jorik 847-508-5409; Custom printed wall covering.
 - b. DesignTex, contact: Wayne Borsheim 773-551-6413; Custom printed wall covering on RECore Smooth substrate.
 - c. D.L. Couch, contact: Celine Ehlers 312-420-1242; Custom printed wall covering.
 - d. MDC Wall Covering, contact: Mary Gwen Evans 312-315-4705; Custom printed wall covering.

- e. Point Imaging, contact: Brandon O'Brien 219-947-0200; Custom printed wall covering.
- B. Total Weight Excluding Coatings: Minimum 13 ounces per yard.
- C. Width: 54 inches.
- D. Backing: Nonwoven fabric.
- E. Colors, Textures, and Patterns: Custom printed graphic provided by Architect in .eps file format.
- F. Tensile Strength: 92 x 92.
- G. Tear Strength: 55 x 40.
- H. Printing: Digitally printed 8 color solvent inks.

2.3 ACCESSORIES

- A. Adhesive: Mildew-resistant, nonstaining adhesive, for use with specific wall covering and substrate application; as recommended in writing by wall-covering manufacturer.
 - 1. Adhesive shall have VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Primer/Sealer: Mildew resistant, complying with requirements in Section 09 91 23 "Interior Painting" and recommended in writing by wall-covering manufacturer for intended substrate.
- C. Seam Tape: As recommended in writing by wall-covering manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, mildew, and incompatible primers.
- C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.

1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
 2. Plaster: Allow new plaster to cure. Neutralize areas of high alkalinity. Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
 3. Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
 4. Painted Surfaces: Treat areas susceptible to pigment bleeding.
- D. Check painted surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finish with fine sandpaper.
- E. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.
- F. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.3 INSTALLATION

- A. General: Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated except where more stringent requirements apply.
- B. Cut wall-covering strips in roll number sequence. Change roll numbers at partition breaks and corners.
- C. Install strips in same order as cut from roll.
- D. Install wall covering with no gaps or overlaps, no lifted or curling edges, and no visible shrinkage.
- E. Install seams vertical and plumb at least 6 inches from outside corners and 6 inches from inside corners unless a change of pattern or color exists at corner. No horizontal seams are permitted.
- F. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.
- G. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without any overlay or spacing between strips.

3.4 CLEANING

- A. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.
- B. Use cleaning methods recommended in writing by wall-covering manufacturer.
- C. Replace strips that cannot be cleaned.
- D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 09 72 00

SECTION 09 84 33 - SOUND-ABSORBING WALL UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes shop-fabricated, fabric-wrapped panel units tested for acoustical performance, including:
 - 1. Sound-absorbing wall panels.

1.3 DEFINITIONS

- A. NRC: Noise Reduction Coefficient.
- B. SAA: Sound Absorption Average.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of panel edge, core material, and mounting indicated.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
 - 2. Product Certificates for Credit MR 5.1: For products and materials required to comply with requirements for regionally manufactured materials. Include statement indicating cost, location of manufacturer, and distance to Project for each regionally manufactured material.
 - 3. Product Data for Credit IEQ 4.1: For installation adhesives, documentation including printed statement of VOC content and chemical components.
 - 4. Product Data for Credit IEQ 4.4: For composite wood products used in sound-absorbing wall units, documentation indicating that product contains no urea formaldehyde.
- C. Shop Drawings: For sound-absorbing wall units. Include mounting devices and details; details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge and core materials.
 - 1. Include elevations showing panel sizes and direction of fabric weave and pattern matching.

- D. Samples for Verification: For the following products, prepared on Samples of size indicated below:
1. Panel Edge: 12-inch- long Sample(s) showing each edge profile, corner, and finish.
 2. Core Material: 12-inch- square Sample at corner.
 3. Mounting Devices: Full-size Samples.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sound-absorbing wall units to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal recommendations.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain sound-absorbing wall units from single source from single manufacturer.
- B. Fire-Test-Response Characteristics: Provide sound-absorbing wall units meeting the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
1. Surface-Burning Characteristics: As determined by testing per ASTM E 84.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 2. Fire Growth Contribution: Meeting acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 286.
- C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials, fabrication, and installation.
1. Build mockup of typical wall area as directed by Architect .
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with fabric and sound-absorbing wall unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
- B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install sound-absorbing wall units until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Lighting: Do not install sound-absorbing wall units until a permanent level of lighting is provided on surfaces to receive the units.
- C. Air-Quality Limitations: Protect sound-absorbing wall units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.
- D. Field Measurements: Verify locations of sound-absorbing wall units and actual dimensions of openings and penetrations by field measurements before fabrication.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sound-absorbing wall units that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to the following:
 - a. Acoustical performance.
 - b. Warping of core.
 - 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

- A. Type AWP-1: Tectum Inc.; 1 inch Acoustic Wall Panel, 144 in length, widths as indicated on Drawings; horizontal orientation; bevel edge; field-painted to match colors indicated on Drawings. Direct attach panel with tapcon flathead screws to metal framing. Screws to be field painted to match panel color.
- B. Type AWP-2: Tectum Inc.; 1-1/2" inch Acoustic Wall Panel, 108 in length, widths as indicated on Drawings; vertical orientation; square edge; factory-painted to match color Benjamin Moore 2120-30. Direct attach panel with tapcon flathead screws to precast panel. Screws to be field painted to match panel color.

2.2 MATERIALS

- A. General:
 - 1. Minimum Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25percent by weight.
 - 2. Regional Materials: Sound-absorbing wall units shall be manufactured within 500 miles of Project site.

- B. Core Materials: Manufacturer's standard.

2.3 FABRICATION

- A. General: Use manufacturer's standard construction except as otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warpage and damage.
- B. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch for the following:
 - 1. Thickness.
 - 2. Edge straightness.
 - 3. Overall length and width.
 - 4. Squareness from corner to corner.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fabric, fabricated units, substrates, areas, and conditions, for compliance with requirements, installation tolerances, and other conditions affecting performance of sound-absorbing wall units.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install sound-absorbing wall units in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.
- B. Comply with sound-absorbing wall unit manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.

3.3 INSTALLATION TOLERANCES

- A. Variation from Plumb and Level: Plus or minus 1/16 inch.
- B. Variation of Panel Joints from Hairline: Not more than 1/16 inch wide.

3.4 CLEANING

- A. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 09 84 33

SECTION 09 91 13 - 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. Galvanized metal.
 - 2. Exterior portland cement plaster (stucco).
- B. Related Requirements:
 - 1. Section 09 96 00 "High-Performance Coatings" for special-use coatings.
 - 2. Section 09 91 23 "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.
- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. 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, with the proposed product highlighted.
3. VOC content.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- B. Products: Subject to compliance with requirements, [provide product] [provide one of the products] [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 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.
- C. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.
- D. Colors: As indicated in a color schedule.

2.3 METAL PRIMERS

- A. Primer, Galvanized: As recommended in writing by topcoat manufacturer.

2.4 WATER-BASED PAINTS

- A. Latex, Exterior Low Sheen (Gloss Level 3-4): MPI #15.

2.5 TEXTURED AND HIGH-BUILD COATINGS

- A. Latex, Exterior, High Build: MPI #40.

2.6 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 paints 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. Portland Cement Plaster: 12 percent.
- C. Portland Cement Plaster Substrates: Verify that plaster is fully cured.
- 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 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. 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.

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.

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 EXTERIOR PAINTING SCHEDULE

A. Galvanized-Metal Substrates:

1. Latex System:

- a. Prime Coat: Primer, galvanized metal, as recommended in writing by topcoat manufacturer for exterior use on galvanized-metal substrates with topcoat indicated.
- b. Intermediate Coat: Latex, exterior, matching topcoat.
- c. Topcoat: Latex, exterior, low sheen (Gloss Level 3-4), MPI #15.

B. Portland Cement Plaster Substrates:

1. High-Build Latex System: Dry film thickness not less than 10 mils.

- a. Prime Coat: As recommended in writing by topcoat manufacturer.
- b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
- c. Topcoat: Latex, exterior, high build, MPI #40.

END OF SECTION 09 91 13

SECTION 09 91 23 - 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 the following interior substrates:
 - 1. Concrete masonry units (CMU).
 - 2. Steel.
 - 3. Galvanized metal.
 - 4. Wood.
 - 5. Gypsum board.
 - 6. Plaster.
 - 7. ASJ insulation covering.
- B. Related Requirements:
 - 1. Section 09 96 00 "High-Performance Coatings" for high-performance and special-use coatings.
 - 2. Section 09 91 13 "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. LEED Submittals:
 - 1. Product Data for Credit EQ 4.2: For paints and coatings, including printed statement of VOC content.
- C. Samples for Initial Selection: For each type of topcoat product.
- D. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- E. Product List: 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 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 DELIVERY, STORAGE, AND HANDLING

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

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 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 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.
- C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 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.
- D. Colors: As indicated in a color schedule.

2.2 BLOCK FILLERS

- A. Block Filler, Latex, Interior/Exterior: MPI #4.

2.3 PRIMERS/SEALERS

- A. Primer Sealer, Latex, Interior: MPI #50.
- B. Primer, Latex, for Interior Wood: MPI #39.

2.4 METAL PRIMERS

- A. Primer, Galvanized, Water Based: MPI #134.

2.5 WATER-BASED PAINTS

- A. Latex, Interior, (Gloss Level 3): MPI #52.
- B. Latex, Interior, High Performance Architectural, (Gloss Level 3): MPI #139.
- C. Latex, Interior, High Performance Architectural, (Gloss Level 4): MPI #140.
- D. Latex, Interior, High Performance Architectural, Semi-Gloss (Gloss Level 5): MPI #141.

2.6 FLOOR COATINGS

- A. Sealer, Water Based, for Concrete Floors: MPI #99.

2.7 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. Masonry (Clay and CMU): 12 percent.
 - 2. Wood: 15 percent.
 - 3. Gypsum Board: 12 percent.
 - 4. Plaster: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

- D. Plaster Substrates: Verify that plaster is fully cured.
- E. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- F. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions 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 but not less than the following:
 - 1. SSPC-SP 3, "Power Tool Cleaning."
- 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.
- G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- H. Wood Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 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 Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.
 - 2. 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 PAINTING SCHEDULE

- A. Concrete Substrates, Traffic Surfaces:
 1. Water-Based Clear Sealer System:
 - a. First Coat: Sealer, water based, for concrete floors, MPI #99.
 - b. Topcoat: Sealer, water based, for concrete floors, MPI #99.
- B. CMU Substrates:
 1. High-Performance Architectural Latex System:
 - a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural, (Gloss Level 4), MPI #140.
- C. Steel Substrates:
 1. High-Performance Architectural Latex System:
 - a. Prime Coat: Shop primer specified in Section 05 12 00 "Structural Steel Framing" where substrate is specified.
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural, semi-gloss (Gloss Level 5), MPI #141.
- D. Galvanized-Metal Substrates:

1. High-Performance Architectural Latex System:
 - a. Prime Coat: Primer, galvanized, water based, MPI #134.
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural, semi-gloss (Gloss Level 5), MPI #141.

- E. Wood Substrates: Including wood-based panel products .
 1. High-Performance Architectural Latex System:
 - a. Prime Coat: Primer, latex, for interior wood, MPI #39.
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural, (Gloss Level 3), MPI #139.

- F. Gypsum Board Substrates:
 1. High-Performance Architectural Latex System:
 - a. Prime Coat: Primer sealer, latex, interior, MPI #50.
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural, (Gloss Level 3), MPI #139.

- G. ASJ Insulation-Covering Substrates: Including pipe and duct coverings.
 1. Latex System:
 - a. Prime Coat: Primer sealer, latex, interior, MPI #50.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, (Gloss Level 3), MPI #52.

END OF SECTION 09 91 23

SECTION 09 96 00 - HIGH-PERFORMANCE COATINGS

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 application of high-performance coating systems on the following substrates:

- 1. Exterior Substrates:

- a. Concrete, vertical surfaces.
 - b. Galvanized metal.

- 2. Interior Substrates:

- a. Concrete, vertical surfaces.
 - b. Concrete masonry units (CMU).
 - c. Steel.
 - d. Wood.
 - e. Gypsum board.

- B. Related Requirements:

- 1. Section 09 91 13 "Exterior Painting" for special-use coatings and general field painting.
 - 2. Section 09 91 23 "Interior Painting" for special-use coatings and general field painting.

1.3 DEFINITIONS

- A. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- B. 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 indicated. Include preparation requirements and application instructions.
- B. LEED Submittals:
 - 1. Product Data for Credit EQ 4.2: For interior coatings, documentation including printed statement of VOC content.

- C. Samples for Initial Selection: For each type of topcoat product indicated.
- D. Samples for Verification: For each type of coating system and in each color and gloss of topcoat indicated.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- E. Product List: 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 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Coatings: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 DELIVERY, STORAGE, AND HANDLING

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

1.7 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 HIGH-PERFORMANCE COATINGS, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and are

listed in "MPI Approved Products List."

- B. Material Compatibility:
 - 1. Provide materials for use within each coating 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 coating system, provide products recommended in writing by manufacturers of topcoat for use in coating system and on substrate indicated.
 - 3. Provide products of same manufacturer for each coat in a coating system.

- C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior coatings applied at project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 1. Flat Paints and Coatings: 50 g/L.
 - 2. Nonflat Paints and Coatings: 150 g/L.
 - 3. Primers, Sealers, and Undercoaters: 200 g/L.
 - 4. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: 250 g/L.
 - 5. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
 - 6. Pre-Treatment Wash Primers: 420 g/L.
 - 7. Floor Coatings: 100 g/L.
 - 8. Shellacs, Clear: 730 g/L.
 - 9. Shellacs, Pigmented: 550 g/L.

- D. Colors: As indicated in color schedule.

2.2 BLOCK FILLERS

- A. Block Filler, Epoxy: MPI #116.

2.3 INTERIOR PRIMERS/SEALERS

- A. Primer Sealer, Latex, Interior: MPI #50.

2.4 EPOXY COATINGS

- A. Epoxy, Gloss: MPI #77.

2.5 SOURCE QUALITY CONTROL

- A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:
 - 1. Owner will engage the services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If coating 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 paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings 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.
 1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - a. Concrete: 12 percent.
 - b. Masonry (Clay and CMU): 12 percent.
 - c. Wood: 15 percent.
 - d. Gypsum Board: 12 percent.
- B. Plaster Substrates: Verify that plaster is fully cured.
- 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. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification 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.
- C. Clean substrates of substances that could impair bond of coatings, 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 coating systems indicated.

- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
 - 1. Clean surfaces with pressurized water. Use pressure range of 1500 to 4000 psi at 6 to 12 inches.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions.
 - 1. Clean surfaces with pressurized water. Use pressure range of 1500 to 4000 psi at 6 to 12 inches.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.
- G. 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 high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 - 1. Use applicators and techniques suited for coating and substrate indicated.
 - 2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
- D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner will engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
 - 1. Contractor shall touch up and restore coated surfaces damaged by testing.

2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating 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 coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, 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 coated surfaces.

3.6 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

- A. Concrete Substrates, Vertical Surfaces:
 1. Epoxy System:
 - a. Prime Coat: Epoxy, gloss, MPI #77.
 - b. Intermediate Coat: Epoxy, gloss, MPI #77.
 - c. Topcoat: Epoxy, gloss, MPI #77.
- B. Galvanized-Metal Substrates:
 1. Epoxy System:
 - a. Prime Coat: Primer, epoxy, as recommended in writing by topcoat manufacturer.
 - b. Intermediate Coat: Epoxy, gloss.
 - c. Topcoat: Epoxy, gloss, MPI #77.

3.7 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

- A. FOR SURFACES INDICATED TO RECEIVE "HP-x" COATING:
 1. Basis-of-Design: Provide PPG Paints; Aquapon WB 98-1, or comparable product by one of the following:
 - a. Glidden; 2 part water-based epoxy, satin sheen.
 - b. Sherwin Williams; 2 part water-based epoxy, satin sheen.
 2. Provide prime coat, and block filler when on CMU substrate, as recommended by manufacturer. Provide number of finish coats recommended by manufacturer.

- B. FOR SURFACES INDICATED TO RECEIVE "EP-x" COATING:
1. Provide one of the following:
 - a. Dex-O-Tex; Wallcote E with Dexotex Quik-Glaze top coat.
 - b. Dur-A-Flex; Dur-a-Wall, with two coats of satin finish urethane top coat.
 - c. Sherwin Williams; Saniglaze, with water-based polyurethane finish coat.
 - d. Stonehard; Stoneglaze VSR, with urethane top coat.
 2. Provide prime coat, and block filler when on CMU substrate, as recommended by manufacturer. Provide number of finish coats recommended by manufacturer.

END OF SECTION 09 96 00

SECTION 10 11 00 - VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Markerboards.
 - 2. Visual display wall coverings.

1.3 DEFINITIONS

- A. Visual Display Board Assembly: Visual display surface that is factory fabricated into composite panel form, either with or without a perimeter frame; includes chalkboards, markerboards, and tackboards.
- B. Visual Display Surface: Surfaces that are used to convey information visually, including surfaces of chalkboards, markerboards, tackboards, and surfacing materials that are not fabricated into composite panel form but are applied directly to walls.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for visual display surfaces.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For adhesives, documentation including printed statement of VOC content.
 - 2. Product Data for Credit IEQ 4.4: For composite wood products, documentation indicating that the product contains no urea formaldehyde.
- C. Shop Drawings: For visual display surfaces. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Show locations of panel joints.
 - 2. Include sections of typical trim members.
- D. Samples for Initial Selection: For each type of visual display surface indicated, for units with factory-applied color finishes, and as follows:
 - 1. Actual sections of visual display wall covering.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For visual display surfaces to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain visual display surfaces from single source from single manufacturer.
- B. 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. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 50 or less.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver factory-built visual display surfaces[, including factory-applied trim where indicated,] completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefabricate components at the factory, disassemble for delivery, and make final joints at the site.
- B. Store visual display surfaces vertically with packing materials between each unit.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install visual display surfaces until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Verify actual dimensions of construction contiguous with visual display surfaces by field measurements before fabrication.
 - 1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

1.9 WARRANTY

- A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:

- a. Surfaces lose original writing and erasing qualities.
 - b. Surfaces exhibit crazing, cracking, or flaking.
2. Warranty Period: 50 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Porcelain-Enamel Face Sheet: Manufacturer's standard steel sheet with porcelain-enamel coating fused to steel; uncoated thickness indicated.
 - 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. Claridge Products and Equipment, Inc.
 - b. PolyVision Corporation; a Steelcase company.
 - 2. Gloss Finish: Gloss as indicated; dry-erase markers wipe clean with dry cloth or standard eraser.
- B. Hardboard: ANSI A135.4, tempered.
- C. Particleboard: ANSI A208.1, Grade M-1, made with binder containing no urea formaldehyde.
- D. Fiberboard: ASTM C 208.
- E. Extruded Aluminum: ASTM B 221, Alloy 6063.

2.2 MARKERBOARD ASSEMBLIES (MB-X)

- A. Porcelain-Enamel Markerboards: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction consisting of backing sheet, core material, and 0.021-inch- thick, porcelain-enamel face sheet with high -gloss finish.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AARCO Products, Inc.
 - b. ADP Lemco, Inc.
 - c. Aywon.
 - d. Bangor Cork Company, Inc.
 - e. Best-Rite Manufacturing.
 - f. Claridge Products and Equipment, Inc.
 - g. Ghent Manufacturing, Inc.
 - h. Marsh Industries, Inc.; Visual Products Group.
 - i. Platinum Visual Systems; a division of ABC School Equipment, Inc.
 - j. PolyVision Corporation; a Steelcase company.
 - k. Tri-Best Visual Display Products.

2. Manufacturer's Standard Core: Minimum 1/4 inch thick, with manufacturer's standard moisture-barrier backing.
3. Laminating Adhesive: Manufacturer's standard, moisture-resistant thermoplastic type.

2.3 VISUAL DISPLAY WALL COVERINGS (WC-1)

- A. Wallcovering Type WC-1: Egan Visual; VersaPRO-G, 48 inch width. Contact: Tom Karras, 773-318-1344, tom@svkcontract.com.
 1. Marker Tray: Egan Visual, EganAero marker tray (ACEAT); 12 inch width, mounted to location selected by architect.
 2. Accessories: Provide 2 per room:
 - a. Dry Erase Markers (ACDZ)
 - b. EganCloth (EVEC)
- B. Adhesive: Mildew-resistant, nonstaining, strippable adhesive, for use with specific wall covering and substrate application, as recommended in writing by wall covering manufacturer.

2.4 MARKERBOARD ACCESSORIES

- A. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- thick, extruded aluminum; standard size and shape.
 1. Factory-Applied Trim: Manufacturer's standard.
- B. Chalktray: Manufacturer's standard, continuous, unless noted otherwise in Visual Display Surface Schedule.
 1. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.

2.5 FABRICATION

- A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.
- B. Visual Display Boards: Factory assemble visual display boards unless otherwise indicated.
 1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display boards at manufacturer's factory before shipment.
- C. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.
 1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, as indicated on approved Shop

- Drawings.
2. Provide manufacturer's standard vertical-joint spline H-trim system between abutting sections of markerboards.
 3. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.
- D. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to a neat, hairline closure.
1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

2.6 GENERAL FINISH REQUIREMENTS

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

2.7 ALUMINUM FINISHES

- A. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.

2.8 VISUAL DISPLAY SURFACE SCHEDULE

- A. Visual Display Board (MB-X, where X is width in feet): Factory assembled.
 1. Markerboard: Porcelain-enamel markerboard assembly.
 - a. Color: White.
 2. Corners: Square.
 3. Width: As indicated on Drawings.
 4. Height: 48 inches.
 5. Mounting: Wall.
 6. Mounting Height: 36 inches above finished floor.
 7. Factory -Applied Aluminum Trim: Manufacturer's standard with clear anodic finish.
 8. Accessories:
 - a. Chalktray: Solid type.
- B. Floating Markerboard at Recruiting Room 2003:
 1. Manufacturer: Egan Visual.

2. Product: Dimension Marker Board, DP7248SWWH.
3. Size: 48 inches by 72 inches.
4. Corner: Small radius, 1/8 inch.
5. Edge Finish: White.
6. Surface Use: Dry-erase.
7. Installation Method: Floating.
8. Accessories:
 - a. Self-adhesive aluminum tray, ACDT12.
 - b. VersaEraser, 6 pack, EVVE6.
 - c. Assorted EganMarkers, 3 each of all 4 colors, ACDZ.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.
- B. Examine walls and partitions for proper preparation and backing for visual display surfaces.
- C. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances that could impair the performance of and affect the smooth, finished surfaces of visual display boards, including dirt, mold, and mildew.
- C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display surfaces and wall surfaces.
 1. Prime wall surfaces indicated to receive visual display wall coverings and as recommended in writing by primer/sealer manufacturer and wall covering manufacturer.
- D. Prepare recesses for sliding visual display units as required by type and size of unit.

3.3 INSTALLATION, GENERAL

- A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

3.4 INSTALLATION OF FACTORY-FABRICATED VISUAL DISPLAY BOARDS AND ASSEMBLIES

- A. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches o.c. Secure both top and bottom of boards to walls.

3.5 CLEANING AND PROTECTION

- A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.
- B. Touch up factory-applied finishes to restore damaged or soiled areas.
- C. Cover and protect visual display surfaces after installation and cleaning.

END OF SECTION 10 11 00

SECTION 10 14 23 - PANEL SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Pressure Applied Vinyl signs for textured and smooth surfaces.
 - 2. Field-applied, vinyl-character signs.

1.3 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION

- A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.
- B. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For adhesives, documentation including printed statement of VOC content.
- C. Shop Drawings: For panel signs.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 - 3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image.
 - c. Separation or delamination of sheet materials and components.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANEL SIGNS, GENERAL

- A. Regional Materials: Panel signs shall be manufactured within 500 miles of Project site.

2.2 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for signs.

2.3 PRESSURE APPLIED VINYL SIGNS

- A. Pressure Applied Vinyl for Textured Surfaces: For use on CMU substrates in Locker Rooms.
 - 1. Manufacturer: 3M; Scotchgal Textured Surface Vinyl.
 - 2. Custom printed and electrocut 14 inch lettering, width as indicated on Drawings.
- B. Pressure Applied Vinyl for Smooth Surfaces: For use on stacking panel door (specified in Section 06 41 16) at Concessions Room.
 - 1. Manufacturer: 3M; Scotchgal Graphic Film IJ3650-10 White.
 - 2. Custom printed full color image, size as indicated on Drawings. Artwork to be supplied by Architect.

2.4 FIELD-APPLIED, VINYL-CHARACTER SIGNS

- A. Field-Applied, Vinyl-Character Sign : Prespaced characters die cut from 3- to 3.5-mil thick, weather-resistant vinyl film with release liner on the back and carrier film on the front for on-site alignment and application.
 - 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. APCO Graphics, Inc.
 - b. ASI Sign Systems, Inc.
 - c. Best Sign Systems Inc.
 - 2. Size: As indicated.
 - 3. Substrate: As indicated.
 - 4. Text and Font: As indicated.

2.5 PANEL-SIGN MATERIALS

- A. Vinyl Film: UV-resistant vinyl film of nominal thickness indicated, with pressure-sensitive, permanent adhesive on back; die cut to form characters or images as indicated and suitable for exterior applications.

2.6 GENERAL FINISH REQUIREMENTS

- A. 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.
- B. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

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 zesignage work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
 - 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

- B. Field-Applied, Vinyl-Character Signs: Clean and dry substrate. Align sign characters in final position before removing release liner. Remove release liner in stages, and apply and firmly press characters into final position. Press from the middle outward to obtain good bond without blisters or fishmouths. Remove carrier film without disturbing applied vinyl film.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

- B. Remove temporary protective coverings and strippable films as signs are installed.

- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 23

SECTION 10 21 13 - 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.
- B. Related Sections:
 - 1. Section 055000 "Metal Fabrications" for supports that attach ceiling-hung compartments to overhead structural system.
 - 2. Section 06 10 35 "Miscellaneous Rough Carpentry" for blocking .
 - 3. Section 10 28 00 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories.

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. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.4: For particleboard, documentation indicating that product contains no urea formaldehyde.
- C. 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.
 - 4. Show ceiling grid and overhead support or bracing locations.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.5 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: 75 or less.
 - 2. Smoke-Developed Index: 450 or less.
- C. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1 for toilet compartments designated as accessible.

1.6 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. Steel Sheet: Commercial steel sheet for exposed applications; mill phosphatized and selected for smoothness.
- B. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.
- C. Stainless-Steel Castings: ASTM A 743/A 743M.
- D. Particleboard: ANSI A208.1, Grade M-2 with 45-lb density., made with binder containing no urea formaldehyde.

2.2 STEEL UNITS

- 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. Accurate Partitions Corporation.
 - 2. All American Metal Corp.
 - 3. Flush Metal Partition Corp.
 - 4. Global Steel Products Corp.
 - 5. Hadrian Manufacturing Inc.
- B. Toilet-Enclosure Style: Ceiling hung.
- 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.[Provide with no-sightline system.] 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 for doors and panels and 1-1/4 inches 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 or hot-dip galvanized-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.
 2. Pilasters, Unbraced at One End: Manufacturer's standard thickness, but not less than 0.048 inch.
 3. Panels: [Manufacturer's standard thickness, but not less than 0.030 inch] [0.036 inch].
 4. Doors: Manufacturer's standard thickness, but not less than 0.030 inch.
 5. Integral-Flange, Wall-Hung Urinal Screens: Manufacturer's standard thickness, but not less than 0.030 inch.
- G. Pilaster Shoes and Sleeves (Caps): Stainless-steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.
- H. Brackets (Fittings):
1. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.
- 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: Stainless steel.
 2. Hinges: Manufacturer's standard continuous, cam type that swings to a closed or partially open position.

3. Latch and Keeper: Manufacturer's standard surface-mounted 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. 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. Ceiling-Hung Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for connection to structural support above finished ceiling. Provide assemblies that support pilasters from structure without transmitting load to finished ceiling. Provide sleeves (caps) at tops of pilasters to conceal anchorage.
- B. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, in-swinging doors for standard toilet compartments and 36-inch- wide, out-swinging doors with a minimum 32-inch- 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.
 - b. Panels and Walls: 1 inch.
- B. Ceiling-Hung Units: Secure pilasters to supporting structure and level, plumb, and tighten. Hang doors and adjust so bottoms of doors are level with bottoms of pilasters 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 10 21 13

SECTION 10 22 38 - OPERABLE PANEL PARTITIONS

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. Manually operated, acoustical panel partitions.

- B. Related Requirements:

- 1. Section 05 50 00 "Metal Fabrications" for supports that attach supporting tracks to overhead structural system.
- 2. Section 09 29 00 "Gypsum Board" for fire-rated assemblies and sound barrier construction above the ceiling at track.
- 3. Electrical and communications Sections for electrical service and connections for motor operators, controls, and limit switches and for system disconnect switches.

1.3 DEFINITIONS

- A. STC: Sound Transmission Class.

1.4 ACTION SUBMITTALS

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

- B. LEED Submittals:

- 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
- 2. Product Data for Credit IEQ 4.4: For composite wood products, documentation indicating that products contain no urea formaldehyde.

- C. Shop Drawings: For operable panel partitions.

- 1. Include plans, elevations, sections, details, numbered panel installation sequence, and attachments to other work.
- 2. Indicate stacking and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.

- D. Samples for Initial Selection: For each type of exposed material, finish, covering, or facing.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Partition track, track supports and bracing, switches, turning space, and storage layout.
 - 2. Suspended ceiling components.
 - 3. Structural members to which suspension systems are attached.
 - 4. Size and location of initial access modules for acoustical tile.
 - 5. Items penetrating finished ceiling, including the following:
 - a. Lighting fixtures.
 - b. HVAC ductwork, outlets, and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Smoke detectors.
 - f. Access panels.
 - 6. Plenum acoustical barriers.
- B. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For operable panel partitions to include in maintenance manuals.
 - 1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
 - a. Panel finish facings and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
 - b. Seals, hardware, track, track switches, carriers, and other operating components.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protectively package and sequence panels in order for installation. Clearly mark packages and panels with numbering system used on Shop Drawings. Do not use permanent markings on panels.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of operable panel partitions.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties according to test methods indicated:
 - 1. Sound-Transmission Requirements: Operable panel partition assembly tested for laboratory sound-transmission loss performance according to ASTM E 90, determined by ASTM E 413, and rated for not less than the STC indicated.
- B. Fire-Test-Response Characteristics: Provide panels with finishes complying with one of the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Surface-Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 - 2. Fire Growth Contribution: Complying with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 286.

2.2 OPERABLE ACOUSTICAL PANELS

- A. Operable Acoustical Panels: Partition system, including panels, seals, finish facing, suspension system, operators, and accessories.
 - 1. Manufacturers: Subject to compliance with requirements, provide one of the following:

- a. Hufcor, Inc.; Series 642 Paired Panels.
 - b. Moderco, Inc.; Signature 8500 Paired Panels.
 - c. Panelfold, Inc.; Moduflex 820 Paired Panels.
- B. Panel Construction: As required to support panel from suspension components and with reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.
- C. Dimensions: Fabricate operable acoustical panel partitions to form an assembled system of dimensions indicated and verified by field measurements.
 - 1. Panel Width: Equal widths.
- D. STC: Not less than 52.
- E. Panel Weight: 10 lb/sq. ft. maximum.
- F. Panel Thickness: Not less than 3-1/2 inches.
- G. Panel Materials:
 - 1. Recycled Content of Operable Panel Partitions:
 - a. Recycled Content of Steel: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent by weight.
 - 2. Steel Frame: Steel sheet, manufacturer's standard nominal minimum thickness for uncoated steel.
 - 3. Steel Face/Liner Sheets: Tension-leveled steel sheet, manufacturer's standard minimum nominal thickness for uncoated steel.
 - 4. Particleboard: ANSI A208.1, made with binder containing no urea formaldehyde.
 - 5. Medium-Density Fiberboard: ANSI A208.2, made with binder containing no urea formaldehyde.
 - 6. Plywood: DOC PS 1; made with adhesive containing no urea formaldehyde.
- H. Panel Closure: Manufacturer's standard unless otherwise indicated.
- I. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.
 - 1. Hinges: Manufacturer's standard.

2.3 SEALS

- A. General: Provide seals that produce operable panel partitions complying with performance requirements and the following:
 - 1. Manufacturer's standard seals unless otherwise indicated.
- B. Horizontal Top Seals: Continuous-contact, extruded-PVC seal exerting uniform constant

pressure on track or PVC-faced, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on track when extended.

- C. Horizontal Bottom Seals: Manufacturer's standard continuous-contact seal exerting uniform constant pressure on floor.

2.4 PANEL FINISH FACINGS

- A. General: Provide finish facings for panels that comply with indicated fire-test-response characteristics and that are factory applied to operable panel partitions with appropriate backing, using mildew-resistant nonstaining adhesive as recommended by facing manufacturer's written instructions.
 - 1. Apply one-piece, seamless facings free of air bubbles, wrinkles, blisters, and other defects, with edges tightly butted, and with invisible seams complying with Shop Drawings for location, and with no gaps or overlaps. Horizontal seams are not permitted. Tightly secure and conceal raw and selvage edges of facing for finished appearance.
 - 2. Where facings with directional or repeating patterns or directional weave are indicated, mark facing top and attach facing in same direction.
 - 3. Match facing pattern 72 inches above finished floor.
- B. Vinyl-Coated Fabric Wall Covering: Manufacturer's standard, mildew-resistant, washable, vinyl-coated fabric wall covering; complying with CFFA-W-101-D for type indicated; Class A.
 - 1. Antimicrobial Treatment: Additives capable of inhibiting growth of bacteria, fungi, and yeasts.
 - 2. Color/Pattern: As selected by Architect from manufacturer's full range.
- C. Trimless Edges: Fabricate exposed panel edges so finish facing wraps uninterrupted around panel, covering edge and resulting in an installed partition with facing visible on vertical panel edges, without trim, for minimal sightlines at panel-to-panel joints.

2.5 SUSPENSION SYSTEMS

- A. Tracks: Steel or aluminum with adjustable steel hanger rods for overhead support, designed for operation, size, and weight of operable panel partition indicated. Size track to support partition operation and storage without damage to suspension system, operable panel partitions, or adjacent construction. Limit track deflection to no more than 0.10 inch between bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.
 - 1. Panel Guide: Aluminum guide on both sides of the track to facilitate straightening of the panels; finished with factory-applied, decorative, protective finish.
 - 2. Head Closure Trim: As required for acoustical performance; with factory-applied, decorative, protective finish.
- B. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.

- C. Aluminum Finish: Mill finish or manufacturer's standard, factory-applied, decorative finish unless otherwise indicated.
- D. Steel Finish: Manufacturer's standard, factory-applied, corrosion-resistant, protective coating unless otherwise indicated.

2.6 ACCESSORIES

- A. Storage Pocket Door: Full height at end of partition runs to conceal stacked partition; of same materials, construction, thickness, and acoustical qualities as panels; complete with operating hardware and acoustical seals at soffit, floor, and jambs. Hinges in finish to match other exposed hardware.
 - 1. Frame and door to be manufacturer's standard prime finish steel panel, ready for field painting.
 - 2. Manufacturer's standard method to secure storage pocket door in closed position.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with ASTM E 557 except as otherwise required by operable panel partition manufacturer's written installation instructions.
- B. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed in area of partition installation.
- C. Install panels from marked packages in numbered sequence indicated on Shop Drawings.
- D. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.
- E. Broken, cracked, deformed, or unmatched gasketing or gasketing with gaps at butted ends is not acceptable.
- F. Light-Leakage Test: Illuminate one side of partition installation and observe vertical joints and top and bottom seals for voids. Adjust partitions for alignment and full closure of vertical joints and full closure along top and bottom seals.

3.3 ADJUSTING

- A. Adjust operable panel partitions, hardware, and other moving parts to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust storage pocket doors to operate smoothly and easily, without binding or warping.
- C. Verify that safety devices are properly functioning.

3.4 MAINTENANCE SERVICE

- A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by manufacturer's authorized service representative. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operable-partition operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.5 DEMONSTRATION

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

END OF SECTION 10 22 38

SECTION 10 26 00 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Corner guards.

1.3 ACTION SUBMITTALS

- A. Product Data: Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes for each impact-resistant wall protection unit.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For adhesives, documentation including printed statement of VOC content.
- C. Shop Drawings: For each impact-resistant wall protection unit showing locations and extent. Include sections, details, and attachments to other work.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 - 1. Corner Guards: 12 inches long. Include examples of joinery, corners, and field splices.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall protection units and are based on the specific system indicated. Refer to Section 01 40 00 "Quality Requirements."
- D. Revise subparagraph below to suit Project.
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except

with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

- E. Surface-Burning Characteristics: Provide impact-resistant, plastic wall protection units with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another qualified testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
 - 1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
 - 2. Store plastic wall protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.
 - a. Store corner-guard covers in a vertical position.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F for not less than 72 hours before beginning installation and for the remainder of the construction period.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 - b. Deterioration of plastic and other materials beyond normal use.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Adhesive: As recommended by impact-resistant plastic wall protection manufacturer and with a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.2 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following:
 - 1. Construction Specialties, Inc.; Acrovyn.
 - 2. IPC Door and Wall Protection Systems; Division of InPro Corporation.
 - 3. Korogard Wall Protection Systems; a division of RJF International Corporation.

2.3 CORNER GUARDS

- A. Type CG-1: Fabricated with 90-degree turn to match wall condition.
 - 1. Material: Vinyl.
 - 2. Color: Black.
 - 3. Wing Size: 3/4 by 3/4 inches.
 - 4. Length: Full height of wall to underside of ceiling.
 - 5. Mounting: Surface-mounted with manufacturer's recommended self-adhesive tape. Align bottom with top of wall base.

2.4 FABRICATION

- A. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
- B. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
 - 1. For impact-resistant wall protection units attached with adhesive or foam tape, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

- A. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

3.4 CLEANING

- A. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 10 26 00

SECTION 10 28 00 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Public-use washroom accessories.
 - 2. Public-use shower room accessories.
 - 3. Warm-air dryers.
 - 4. Childcare accessories.
- B. Owner-Furnished Material:
 - 1. TA-1: Toilet Paper Dispenser.
 - 2. TA-6: Wall Mounted Soap Dispenser.
 - 3. TA-7: Wall Mounted Hand Sanitizer Dispenser.
 - 4. TA-8: Wall Mounted Sanitary Napkin Dispenser.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
 - 1. Construction details and dimensions.
 - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Material and finish descriptions.
 - 4. Features that will be included for Project.
 - 5. Manufacturer's warranty.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify products using designations indicated.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Source Limitations: For products that are not sole-sourced, obtain products from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.6 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.7 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.
- C. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- D. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- E. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- F. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- G. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. American Specialties, Inc.
 2. Bobrick Washroom Equipment, Inc.
 3. Bradley Corporation.
- B. Grab Bar : TA-3
1. Mounting: Flanges with concealed fasteners.
 2. Material: Stainless steel, 0.05 inch thick.
 - a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
 3. Outside Diameter: 1-1/2 inches.
 4. Configuration and Length: As indicated on Drawings.
- C. Sanitary-Napkin Disposal Unit Insert drawing designation: TA-2
1. Basis-of-Design Product: <Insert manufacturer's name; product name or designation>.
 2. Mounting: Surface mounted.
 3. Door or Cover: Self-closing, disposal-opening cover and hinged face panel with tumbler lockset.
 4. Receptacle: Removable.
 5. Material and Finish: Stainless steel, No. 4 finish (satin) .
- D. Mirror Unit : TA-5
1. Frame: Frameless; polish all exposed edges.
 - a. Corners: Manufacturer's standard.
 2. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
 - a. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
 3. Size: As indicated on Drawings.
- E. Shelf Unit: TA-9
1. Mounting: Surface mounted.
 2. Size: 18 inches long by 8 inches wide.
 3. Material and finish: Stainless Steel, No. 4 finish (satin.) Provide 18-gauge shelf with hemmed front edge and 16-gauge brackets.

2.3 PUBLIC-USE SHOWER ROOM ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following unless noted otherwise:
1. American Specialties, Inc.
 2. Bobrick Washroom Equipment, Inc.
 3. Bradley Corporation.
- B. Shower Curtain Rod : TA-21
1. Description: 1-1/4-inch OD; fabricated from nominal 0.05-inch- thick stainless steel.
 2. Mounting Flanges: Stainless-steel flanges designed for exposed fasteners.
 3. Finish: No. 4 (satin).
- C. Shower Curtain : TA-21
1. Size: Minimum 12 inches wider than opening by 72 inches high.
 2. Material: Nylon-reinforced vinyl, minimum 10 oz. or 0.008-inch- thick vinyl, with integral antibacterial agent .
 3. Color: As selected from manufacturer's full range .
 4. Grommets: Corrosion resistant at minimum 6 inches o.c. through top hem.
 5. Shower Curtain Hooks: Chrome-plated or stainless-steel, spring wire curtain hooks with snap fasteners, sized to accommodate specified curtain rod. Provide one hook per curtain grommet.
- D. Folding Shower Seat, : TA-20A
1. Configuration: Rectangular seat .
 2. Seat: Phenolic or polymeric composite of slat-type or one-piece construction in color as selected by Architect .
 3. Mounting Mechanism: Stainless steel, No. 4 finish (satin).
 4. Dimensions:
- E. Folding Dressing Room Bench: TA-20B. Provide the following, or comparable, product:
1. www.accessibledesigns.com; D-101-48 with phenolic top.
- F. Towel Pin: TA-22. Basis-of-Design: Bobrick B-677.

2.4 WARM-AIR DRYERS

- A. Warm-Air Dryer : TA-11.
1. Surface mounted, stainless steel. Provide one of the following:
 - a. Excel Dryer; XLERATOReco.
 - b. Palmer Fixture; BluStorm.

2.5 CHILDCARE ACCESSORIES

- A. Diaper-Changing Station : TA-10.

1. Koala Kare; KB200.

2.6 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10 28 00

SECTION 10 44 13 - FIRE EXTINGUISHER 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 Sections:
 - 1. Section 10 44 16 "Fire Extinguishers."

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 for fire protection cabinets.
 - 1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
- 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 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
- B. Transparent Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), 3mm thick, with Finish 1 (smooth or polished).

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. J. L. Industries, Inc., a division of Activar Construction Products Group;
 - c. Kidde Residential and Commercial Division, Subsidiary of Kidde plc;
 - d. Larsen's Manufacturing Company;
 - e. Modern Metal Products, Division of Technico Inc.;
 - f. Moon-American;
 - g. Potter Roemer LLC;
 - h. Watrous Division, American Specialties, Inc.;
- B. Cabinet Construction: Nonrated.
- C. Cabinet Material: Steel sheet.
 - 1. Shelf: Same metal and finish as cabinet.
- D. Recessed Cabinet: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.
 - 1. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
- E. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim. Provide where walls are of insufficient depth for semirecessed cabinet installation.
- F. Cabinet Trim Material: Steel sheet.
- G. Door Material: Steel sheet.
- H. Door Style: Fully glazed panel with frame.
- I. Door Glazing: Acrylic sheet.

1. Acrylic Sheet Color: Clear transparent acrylic sheet.
- J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
1. Provide recessed door pull and friction latch.
 2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.
- K. 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 indicated.
 - a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet glazing.
 - 2) Application Process: Decals.
 - 3) Lettering Color: Black.
 - 4) Orientation: Horizontal.
- L. Finishes:
1. Manufacturer's standard baked-enamel paint for the following:
 - a. Exterior of cabinet , door, and trim except for those surfaces indicated to receive another finish.
 - b. Interior of cabinet and door.
 2. Steel: Baked enamel or powder coat.

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.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 2. 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 "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.

2.5 STEEL FINISHES

- A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning" or SSPC-SP 8, "Pickling" Insert surface preparation method. After cleaning, apply a conversion coating suited to the organic coating to be applied over it.
- B. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where recessed recessed and semirecessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for recessed and 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 acceptable to authorities having jurisdiction.
- B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.

1. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.
- C. Identification: Apply decals 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 10 44 13

SECTION 10 44 16 - 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 and mounting brackets for fire extinguishers.
- B. Owner-Furnished Material: fire extinguishers.
- C. Related Sections:
 - 1. Section 10 44 13 "Fire Extinguisher Cabinets."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- 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 FMG.

1.6 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

1.7 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 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet and mounting bracket indicated.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amerex Corporation.
 - b. Ansul Incorporated; Tyco International Ltd.
 - c. Badger Fire Protection; a Kidde company.
 - d. Buckeye Fire Equipment Company.
 - e. Fire End & Croker Corporation.
 - f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
 - g. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
 - h. Larsen's Manufacturing Company.
 - i. Moon-American.
 - j. Pem All Fire Extinguisher Corp.; a division of PEM Systems, Inc.
 - k. Potter Roemer LLC.
 - l. Pyro-Chem; Tyco Safety Products.
 2. Valves: Manufacturer's standard.
 3. Handles and Levers: Manufacturer's standard.
 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.
- B. Multipurpose Dry-Chemical Type in Steel Container : UL-rated 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.2 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amerex Corporation.
 - b. Ansul Incorporated; Tyco International Ltd.
 - c. Badger Fire Protection; a Kidde company.
 - d. Buckeye Fire Equipment Company.
 - e. Fire End & Croker Corporation.
 - f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
 - g. Larsen's Manufacturing Company.
 - h. Potter Roemer LLC.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Orientation: Vertical.

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 and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
 - 1. Mounting Brackets: 48 inches above finished floor to top of fire extinguisher.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 10 44 16

SECTION 10 51 13 - METAL LOCKERS

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. Heavy-duty metal lockers.
 - 2. Locker benches.
- B. Related Section:
 - 1. Section 10 51 16 "Wood Lockers" for wood-faced and plastic-laminate-faced lockers.

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 for each type of metal locker and bench.
- B. Shop Drawings: For metal lockers. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Show locker trim and accessories.
 - 2. Include locker identification system and numbering sequence.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: For metal lockers and locker benches, in manufacturer's standard sizes.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

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 metal lockers, locker benches, and accessories from single source from single manufacturer.
- C. Regulatory Requirements: Where metal lockers and benches are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.8 COORDINATION

- A. Coordinate sizes and locations of concrete masonry bases for metal lockers.
- B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 - b. Faulty operation of latches and other door hardware.
 - 2. Damage from deliberate destruction and vandalism is excluded.
 - 3. Warranty Period for All-Welded Metal Lockers: Lifetime from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B,

suitable for exposed applications.

- B. Stainless-Steel Sheet: ASTM A 666, Type 304.
- C. Steel Tube: ASTM A 500, cold rolled.
- D. Particleboard: ANSI A208.1, Grade M-2.
- E. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.
- F. Anchors: Material, type, and size required for secure anchorage to each substrate.
 - 1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls for corrosion resistance.
 - 2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.2 HEAVY-DUTY METAL LOCKERS

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Art Metal Products; Bulldog Corridor Lockers.
 - 2. DeBourgh Mfg. Co.; Sentry Corridor/Personnel Lockers.
 - 3. List Industries Inc.; Marquis Protector.
 - 4. Lyon Workspace Products, LLC; All-Welded Lockers.
 - 5. Penco Products, Inc.; All-Welded Lockers.
- B. Locker Arrangement: Single tier and Double tier where shown on Drawings.
- C. Locker Size: 18 inches wide by 18 inches deep by 56 inches height (excluding sloping top).
- D. Material: Cold-rolled steel sheet.
- E. Body: Assembled by welding body components together. Fabricate from unperforated steel sheet with thicknesses as follows:
 - 1. Tops, Bottoms, and Sides: 0.060-inch nominal thickness.
 - 2. Backs: 0.048-inch nominal thickness.
 - 3. Shelves: 0.060-inch nominal thickness, with double bend at front and single bend at sides and back.
- F. Frames: Channel formed; fabricated from 0.060-inch nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral door strike full height on vertical main frames.
 - 1. Cross Frames between Tiers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.
- G. Doors: One piece; fabricated from 0.075-inch nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.

1. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches wide; welded to inner face of doors.
 2. Door Style:
 - a. Security Vents: Manufacturer's standard, stamped horizontal.
- H. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.
1. Continuous Hinges: Manufacturer's standard, steel, full height.
- I. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond face of door; pry and vandal resistant.
1. Multipoint Latching: Finger-lift latch control designed for use with built-in combination locks or padlocks; positive automatic latching and prelocking.
 - a. Latch Hooks: Equip doors 48 inches and higher with three latch hooks and doors less than 48 inches high with two latch hooks; fabricated from 0.120-inch nominal-thickness steel sheet; welded to full-height door strikes; with resilient silencer on each latch hook.
 - b. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.
- J. Equipment: Equip each metal locker with identification plate and the following unless otherwise indicated:
1. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.
 2. Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.
- K. Accessories:
1. Continuous Sloping Tops: Fabricated from 0.048-inch nominal-thickness steel sheet, with a pitch of approximately 20 degrees.
 - a. Closures: Vertical -end type.
 2. Filler Panels: Fabricated from 0.048-inch nominal-thickness steel sheet.
- L. Finish: Baked enamel or powder coat.
1. Color(s): Two colors, where indicated on Drawings.
 - a. Color 1: Black.
 - b. Color 2: Custom gray to match architect's sample.

2.3 LOCKER BENCHES

- A. Provide bench units with overall assembly height of 18 inches.
- B. Bench Tops: Manufacturer's standard one-piece units, with rounded corners and edges.
 - 1. Size: Minimum 1-1/4 inches thick; see Drawings for bench depths.
 - 2. Laminated clear hardwood with one coat of clear sealer on all surfaces and one coat of clear lacquer on top and sides.
- C. Wall-Mounted Bench Support Brackets:
 - 1. Manufacturer: Robinson Steel Co.; www.rsclockers.com
 - 2. Product: Steel Wall Mounted Bracket, black.
 - a. 8 by 12 inches, for use at 15 inch deep bench.
 - b. 15 by 21 inches, for use at +/-23 inch deep bench.

2.4 FABRICATION

- A. Fabricate metal lockers square, rigid, and without warp and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.
 - 1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
 - 2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.
- B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments. Factory weld frame members of each metal locker together to form a rigid, one-piece assembly.
- C. All-Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections; with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds flush.
- D. Accessible Lockers: Fabricate as follows:
 - 1. Locate bottom shelf no lower than 15 inches above the floor.
 - 2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches above the floor.
- E. Hooks: Manufacturer's standard ball-pointed type, aluminum or steel; zinc plated.
- F. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch high.
- G. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.

1. Sloping-top corner fillers, mitered.
- H. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.
- I. Finished End Panels: Designed for concealing unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

2.5 STEEL SHEET FINISHES

- A. Factory finish steel surfaces and accessories except stainless-steel and chrome-plated surfaces.
- B. Baked-Enamel Finish: Immediately after cleaning, pretreating, and phosphatizing, apply manufacturer's standard thermosetting baked-enamel finish. Comply with paint manufacturer's written instructions for application, baking, and minimum dry film thickness.

2.6 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
1. Run grain of directional finishes with long dimension of each piece.
 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install level, plumb, and true; shim as required, using concealed shims.
1. Anchor locker runs at ends and at intervals recommended by manufacturer, but

- not more than 36 inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
2. Anchor single rows of metal lockers to walls near top of lockers and to floor.
 3. Anchor back-to-back metal lockers to floor.
- B. All-Welded Metal Lockers: Connect groups together with standard fasteners, with no exposed fasteners on face frames.
- C. Equipment and Accessories: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
1. Attach hooks with at least two fasteners.
 2. Attach door locks on doors using security-type fasteners.
 3. Identification Plates: Identify metal lockers with identification indicated on Drawings.
 - a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
 4. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.
 5. Attach sloping-top units to metal lockers, with closures at exposed ends.
 6. Attach finished end panels with fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.
- D. Locker Benches: Place benches in locations indicated on Drawings. Align bracket supports with joints between adjoining lockers; space supports at 36 inches max.

3.3 ADJUSTING, CLEANING, AND PROTECTION

- A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.
- B. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.
- C. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 10 51 13

SECTION 10 51 16 - WOOD LOCKERS

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. Wood lockers with plastic-laminate-faced wood doors.
 - 2. Locker benches.

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 for wood lockers.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.4: For adhesives and composite wood products, documentation indicating that products contain no urea formaldehyde.
- C. Shop Drawings: For wood lockers. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 2. Show locations and sizes of cutouts and holes for items installed in wood lockers.
 - 3. Show wood locker fillers, trim, base, sloping tops, and accessories.
 - 4. Show wood locker numbering sequence.
- D. Samples for Initial Selection: For the following:
 - 1. High-pressure decorative laminates.
- E. Samples for Verification: For the following:
 - 1. Plastic-laminate-clad panels, not less than 8 by 10 inches, for each type, color, pattern, and surface finish.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For adjusting, repairing, and replacing wood locker doors and

latching mechanisms to include in maintenance manuals.

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 wood lockers and accessories from single source from single manufacturer.
- C. Regulatory Requirements: Where wood lockers and benches are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities." and ICC/ANSI A117.1.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver wood lockers until painting and similar operations that could damage wood lockers have been completed in installation areas. If wood lockers must be stored in other-than-installation areas, store only in areas where environmental conditions are same as that in final installation location and comply with requirements specified in "Project Conditions" Article.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install wood lockers until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature between 60 and 90 deg F and humidity conditions between 25 and 55 percent during the remainder of the construction period.
- B. Field Measurements: Verify actual dimensions of concealed framing, blocking, and reinforcements that support wood lockers by field measurements before fabrication.

1.8 COORDINATION

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

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of wood lockers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures.

- b. Faulty operation of locks or hardware.
 - c. Deterioration of wood, wood finishes, and other materials beyond normal use.
2. Warranty Period: Three 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. Classic Woodworking, LLC.
 2. Famous Lockers, Inc.
 3. Hollman, Inc.
 4. Ideal Products, Inc.
 5. Legacy Lockers.
 6. Multispace Locker Systems; a division of Club Resource Group.
 7. Treeforms.

2.2 MATERIALS

- A. Solid Wood: Clear hardwood lumber, selected for compatible grain and color.
- B. Particleboard: ANSI A208.1, Grade M-2 .
- C. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, Type I, made with adhesive containing no urea formaldehyde.
- D. Thermoset Decorative Overlay: Surface of thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1 for application over particleboard or medium-density fiberboard.
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as follows:
1. Horizontal Surfaces: Grade HGS.
 2. Postformed Surfaces: Grade HGP.
 3. Vertical Surfaces: Grade VGS.
- F. Adhesives: Adhesives shall not contain urea formaldehyde.
- G. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- H. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage.
1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as indicated on Drawings.
 2. Provide toothed-steel or lead-expansion sleeves for drilled-in-place anchors.

2.3 WOOD LOCKER HARDWARE

- A. General: Provide manufacturer's standard wood locker hardware complying with the requirements in this Section.
- B. Frameless Hinges (European Type): Fully concealed, nickel-plated steel, with not less than 125 degrees of opening.
 - 1. Provide two hinges for doors 42 inches high and less.
 - 2. Provide three hinges for doors more than 42 inches high.
- C. Wire Pulls: Back mounted; 4 inches long, 5/16 inch in diameter.
- D. Exposed Hardware Finishes: Satin chrome unless otherwise indicated.

2.4 DOOR LOCKS

- A. General: Fabricate wood lockers to receive locking devices. Provide one locking device for each wood locker door unless otherwise indicated.
- B. Cam Padlock Hasp: Surface mounted, steel; finished to match other wood locker hardware.

2.5 PLASTIC-LAMINATE-FACED WOOD LOCKERS

- A. Construction Style: Flush overlay .
- B. Locker Body: Fabricated from particleboard -core panels covered on both sides with thermoset decorative overlay.
 - 1. Side Panels: Manufacturer's standard 3/4 or 5/8 inch thick.
 - 2. Back Panel: Manufacturer's standard 1/2 or 3/8 inch thick.
 - 3. Top Panel: Manufacturer's standard 3/4 or 5/8 inch thick.
 - 4. Bottom Panel: Manufacturer's standard 3/4 or 5/8 inch thick.
 - 5. Exposed Panel Edges: 3-mm-thick PVC.
- C. Plastic-Laminate-Faced Wood Doors: High-pressure decorative laminate, Grade VGS, over both sides of particleboard core.
 - 1. Thickness: Manufacturer's standard 3/4 or 5/8 inch thick.
 - 2. Panel Edges: 3-mm-thick PVC.
- D. End Panels: Match style, material, construction, and finish of plastic-laminate-faced wood doors.
- E. Shelves: Fabricated from particleboard -core panels covered on both sides with thermoset decorative overlay; fixed unless otherwise indicated .
 - 1. Thickness: 5/8 inch.
 - 2. Exposed Edges: 3-mm-thick PVC.

- F. Corners and Filler Panels: 3/4-inch- thick panels. Match style, material, construction, and finish of plastic-laminate-faced wood doors.
- G. Plastic-Laminate Colors, Patterns, and Finishes: Laminate PL-4 as scheduled on 'Millwork Finish Types' legend on Drawings.

2.6 LOCKER ACCESSORIES

- A. Hooks: Manufacturer's standard, ball-pointed aluminum or steel; finished to match other wood locker hardware. Attach hooks with at least two fasteners.
 - 1. Provide one double-prong ceiling hook and two single-prong wall hooks for each compartment of single-tier wood lockers.
- B. Number Plates: 1-1/2-inch- diameter, etched, embossed, or stamped, plates with black numbers and letters at least 1/2 inch high. Identify wood lockers in sequence indicated on Drawings. Finish plates to match other wood locker hardware.
- C. Continuously Sloping Tops: Plastic-laminate-faced, 3/4-inch- thick panel that matches door faces for installation over wood lockers with separate flat tops. Fabricate tops in lengths as long as practical, without visible fasteners at splice locations. Provide fasteners, supports, and closures, as follows:
 - 1. Closures: Vertical -end type.
 - 2. Sloping-top corner fillers, mitered.

2.7 LOCKER BENCHES

- A. See Section 10 51 13 "Metal Lockers" for locker bench information.

2.8 FABRICATION

- A. Fabricate each wood locker with shelves, an individual door and frame, an individual top, a bottom, and a back, and with common intermediate uprights separating compartments.
 - 1. Fabricate wood lockers to dimensions, profiles, and details indicated.
 - 2. Ease edges of corners of solid wood members to 1/16-inch radius.
- B. Fabricate components square, rigid, without warp, and with finished faces flat and free of scratches and chips. Accurately machine components for attachments in factory. Make joints tight and true.
 - 1. Fabricate wood lockers using manufacturer's standard construction with joints made with dowels, dados, or rabbets. Dado side panels to receive shelving except where indicated to be adjustable.
- C. Accessible Lockers: Fabricate as follows:
 - 1. Locate bottom shelf no lower than 15 inches above the floor.
 - 2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches above the floor.

- D. Venting: Fabricate wood lockers with space between doors and locker assembly of not less than 3/4 inch, with painted metal security screen attached to each shelf between doors.
- E. Number Plates: Inlay number plates flush in each wood locker door, near top, centered.
- F. Complete fabrication, including assembly, finishing, 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. 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 indicated on Shop Drawings before disassembling for shipment.
- G. Shop cut openings, to maximum extent possible, to receive hardware, 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.
- H. Attach PVC edging to panels by thermally fusing edging to panels after panel fabrication.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting wood locker installation.
- B. Verify that furring is attached to concrete and masonry walls that are to receive wood lockers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Condition wood lockers to average prevailing humidity conditions in installation areas before installation.
- B. Before installing wood lockers, examine factory-fabricated work for completeness and complete work as required, including removal of packing.

3.3 INSTALLATION

- A. Install wood lockers level, plumb, and true; use concealed shims.

- B. Connect groups of wood lockers together with manufacturer's standard brass-finished fasteners, through predrilled holes, with no exposed fasteners on face frames. Fit wood lockers accurately together to form flush, tight, hairline joints.
- C. Install wood lockers without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings, providing unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 1. Installation Tolerance: No more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line. Shim as required with concealed shims.
 - 2. Maintain veneer sequence matching of wood-faced wood lockers.
 - 3. Fasten wood lockers through back, near top and bottom, at ends with No. 8 brass-finished, flush-head wood screws sized for 1-inch penetration into wood base, wood framing, blocking, or furring spaced not more than 16 inches o.c.
- D. Scribe and cut corner and filler panels to fit adjoining work using fasteners concealed where practical. Repair damaged finish at cuts.
- E. Attach sloping-top units to wood lockers, with end panels covering exposed ends.
- F. Install number plates after wood lockers are in place.
 - 1. Attach number plate on each wood locker door, near top, centered, with at least two screws with finish matching number plate.

3.4 ADJUSTING, CLEANING, AND PROTECTING

- A. Clean, lubricate, and adjust hardware. Adjust doors to operate easily without binding.
- B. Protect wood lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.
- C. Touch up marred finishes, or replace wood lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by wood locker manufacturer.

END OF SECTION 10 51 16

SECTION 11 66 23 - GYMNASIUM EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following gymnasium equipment:
 - 1. Basketball equipment.
 - 2. Volleyball equipment.
 - 3. Multi-Sport cage.
 - 4. Group controller and relay panel.
 - 5. Safety pads.
- B. Related Sections include the following:
 - 1. Section 11 66 43 "Interior Electronic Scoreboards" for scoreboard to be mounted to side-folding, side-braced backstop.
 - 2. Section 11 66 53 "Gymnasium Dividers" for divider curtains.

1.3 DEFINITIONS

- A. FIBA: International Basketball Federation (Federation Internationale de Basketball Amateur).
- B. NCAA: The National Collegiate Athletic Association.
- C. NFHS: The National Federation of State High School Associations.
- D. USAV: USA Volleyball.

1.4 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Provide basketball backboards capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. If applicable, include assembly, disassembly, and storage instructions for removable equipment.

2. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.
- B. LEED Submittals:
1. Product Data for Credit IEQ 4.4: For composite wood products, documentation indicating that products contain no urea formaldehyde.
- C. Shop Drawings: For gymnasium equipment. Include plans, elevations, sections, details, attachments to other work, and the following:
1. Method of field assembly for removable equipment, connections, installation details, mountings, floor inserts, attachments to other work, and operational clearances.
 2. Transport and storage accessories for removable equipment.
- D. Samples for Verification: For the following products:
1. Pad Fabric: Not less than 3 inches square, with specified treatments applied. Mark face of material.

1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Court layout plans, drawn to scale, and coordinating floor inserts, game lines, and markers applied to finished flooring.
- B. Structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation including loads, point reactions, and locations for attachment of gymnasium equipment to structure.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For gymnasium equipment to include in emergency, operation, and maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain each type of gymnasium equipment, and divider curtains specified in Section 11 66 53, through a single source from a single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install gymnasium equipment until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, and ambient

temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

- B. Field Measurements: Verify position and elevation of floor inserts and layout for gymnasium equipment.

1.10 COORDINATION

- A. Coordinate installation of floor inserts with structural floors and finish flooring installation and with court layout and game lines and markers on finish flooring.
- B. Coordinate layout and installation of overhead-supported gymnasium equipment and suspension system components with other construction including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of gymnasium equipment that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Basketball backboard failures including glass breakage.
 - b. Faulty operation of any individual component or assembled equipment.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Extruded Bars, Profiles, and Tubes: ASTM B 221.
 - 2. Cast Aluminum: ASTM B 179.
 - 3. Flat Sheet: ASTM B 209.
- B. Steel: Comply with the following:
 - 1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - 2. Steel Tubing: ASTM A 500 or ASTM A 513, cold formed.
 - 3. Steel Sheet: ASTM A 1011/A 1011M.
- C. Support Cable: Manufacturer's standard galvanized steel aircraft cable with a breaking strength of 7000 lb. Provide fittings complying with cable manufacturer's written instructions for size, number, and method of installation.

- D. Support Chain and Fittings: Grade 80 hardened alloy steel chain rated for overhead lifting, ASTM A 391/A 391M, with commercial-quality, hot-dip galvanized steel connectors and hangars.
- E. Castings and Hangers: Malleable iron, ASTM A 47/A 47M, grade required for structural loading.
- F. Softwood Plywood: DOC PS 1, exterior.
- G. Particleboard: ANSI A208.1, made with binder containing no urea formaldehyde.
- H. Anchors, Fasteners, Fittings and Hardware: Manufacturer's standard corrosion-resistant or noncorrodible units; concealed; tamperproof, vandal- and theft-resistant design.
- I. Grout: Nonshrink, nonmetallic, premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107 with minimum strength recommended in writing by gymnasium equipment manufacturer.

2.2 BASKETBALL EQUIPMENT

- C. Basis-of-Design Product: Subject to compliance with requirements, provide Performance Sports Systems or a comparable product by one of the following:
 - 1. Draper Inc.
 - 2. Gared Sports
 - 3. Jaypro Sports, LLC.
 - 4. Performance Sports Systems.
 - 5. Porter Athletic Equipment Company.
- D. General: Provide equipment complying with requirements in FIBA's "FIBA Basketball Rule Book," NCAA's "NCAA Basketball Rule Book," and NFHS's "NFHS Basketball Rule Book."
- E. Protruding fasteners or exposed bolt heads on front face of backboards are not permitted.
- F. Overhead-Supported, Forward-Folding Backstop: For use with Basketball Backstops.
 - 1. Folding Type: Provide manufacturer's standard assembly for forward-folding, front-braced backstops, with hardware and fittings to permit folding.
 - a. Basis-of-Design, Forward-folding, front-braced backstop: Performance Sports Systems; Single Post Backstop; 3106 series.
 - 2. Framing: Steel pipe, tubing, and shapes. Design framing to minimize vibration during play.
 - a. Center-Mast Frame: Welded with side sway bracing.
 - b. Finish: Manufacturer's standard powder-coat finish. Color to be selected by Architect.
- G. Overhead-Supported, Side-Folding Backstop: For use with Electronic Scoreboard specified in section 11 66 43.

1. Folding Type: Provide manufacturer's standard assembly for side-folding, side-braced backstops, with hardware and fittings to permit folding.
 - a. Basis-of-Design, Side-folding, side-braced backstop: Performance Sports Systems; Single Post Backstop; 3108 series.
 2. Framing: Steel pipe, tubing, and shapes. Design framing to minimize vibration during play.
 - a. Provide framing as required to mount electronic scoreboard.
 - b. Center-Mast Frame: Welded with side sway bracing.
 - c. Finish: Manufacturer's standard powder-coat finish. Color to be selected by Architect.
- H. Backstop Safety Device: Designed to limit free fall if support cable, support chain, pulleys, fittings, winch, or related components fail; with mechanical automatic reset; 6000-lb load capacity; one per folding backstop.
1. Basis-of-Design: Performance Sports Systems; 1100 Safstop Locking Device.
- I. Backstop Electric Operator: Provide operating machine of size and capacity recommended by manufacturer for equipment specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, and remote controls. Coordinate wiring requirements and electrical characteristics with building electrical system.
1. Basis-of-Design: Performance Sports Systems; 1194 Electric Hoist.
 2. Operator Type: Cable drum with grooved drum and cable tension device to automatically take up cable slack and retain cable in grooves.
 3. Motor Characteristics: Sufficient to start, accelerate, reverse, and operate connected loads at designated speeds within installed environment and with indicated operating sequence, and without exceeding nameplate rating or considering service factor. Comply with NEMA MG 1, and the following:
 4. Voltage: 120 V.
 5. Horsepower: 3/4 hp.
 6. Enclosure: Manufacturer's standard.
 7. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3300 feet above sea level.
 8. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.
 9. Phase: One.
 10. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop basketball equipment at fully retracted and fully lowered positions.
- J. Basketball Backboard:
1. Basis-of-Design: Performance Sports Systems; AFRG42.
 2. Shape and Size:
 - a. Rectangular, 72 by 42 inches width by height.
 3. Backboard Material: With predrilled holes or preset inserts for mounting goals, and as follows:
 - a. Glass: Not less than 1/2-inch-thick, transparent tempered glass. Provide

glass with impact-absorbing resilient rubber or PVC gasket around perimeter in a fully welded, brushed-natural-finish, extruded-aluminum frame, with steel subframe, reinforcement, and bracing and with mounting slots for mounting backboard frame to backboard support framing.

- 1) Direct Mount: Designed for mounting backboard frame to center mast of backboard framing to maximize relief of stresses on backboard frame and glass.
 - 2) Rim-Restraining Device: Complying with NCAA and NFHS rules and designed to ensure that basket remains attached if glass backboard breaks.
4. Target Area and Border Markings: Permanently etched in white color, marked in pattern and stripe width according to referenced rules.
- K. Goal Mounting Assembly: Compatible with goal, backboard, and support framing; with hole pattern 5 inches o.c. horizontally and 4 inches o.c. vertically for goal attachment.
1. Glass Backboard Goal Mounting Assembly: Goal support framing and reinforcement designed to transmit load from goal to backboard frame and to minimize stresses on glass backboard.
 2. Direct Mount: Designed for mounting goal directly and independently to center mast of backboard support framing so no force, transmitted by ring, is directly applied to backboard and rigidity and stability of goal are maximized.
- L. Basketball Goals: Complete with flanges, braces, attachment plate, and evenly spaced loops welded around underside of ring.
1. Single-Rim Basket Ring Competition Goal: Materials, dimensions, and fabrication complying with referenced rules.
 - a. Basis-of-Design: Performance Sports Systems; 2000+ GARED Collegiate Breakaway Goal.
 2. Type: Movable, breakaway design with manufacturer's standard breakaway mechanism and rebound characteristics identical to those of fixed, nonmovable ring.
 3. Mount: Front.
 4. Net Attachment: No-tie loops for attaching net to rim without tying.
 5. Finish: Powder-coat finish.
- M. Basketball Nets: 12-loop-mesh net, between 15 and 18 inches long, sized to fit rim diameter, and as follows:
1. Competition Cord: Antiwhip, made from white nylon cord not less than 120- or more than 144-gm thread.
- N. Backboard Safety Pads: Designed for backboard thickness indicated and extending continuously along bottom and up sides of backboard and over goal mounting and backboard supports as required by referenced rules.
1. Basis-of-Design: Performance Sports Systems; PMCE GARED Pro-Mold Backboard Padding.
 2. Attachment: Bolt-on.

3. Color: As selected by Architect from manufacturer's full range.
- O. Portable Basketball System: Spring-balanced, height adjustable, portable competition basketball backstop; with backboard, goal, and padding. Provide 2 total.
1. Basis-of-Design: GARED Pro S #9618.
 2. Padding color to be selected from manufacturer's full range.
 3. Provide floor anchoring system appropriate for wood floor specified in section 09 64 66.
 4. Provide supports for shot clock system specified in section 11 66 43.

2.3 VOLLEYBALL EQUIPMENT

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Draper Inc.
 2. Gared Sports
 3. Jaypro Sports, LLC.
 4. Performance Sports Systems.
 5. Porter Athletic Equipment Company.
- B. General: Provide equipment complying with requirements in NFHS's "NFHS Volleyball Rule Book," NCAA's "NCAA Volleyball Rule Book," and USAV's "USA Volleyball Rule Book."
- C. Floor Insert: Solid-brass floor plate; and steel pipe sleeve, concealed by floor plate, with capped bottom end, sized with ID to fit post standards, not less than length required to securely anchor pipe sleeve below finished floor in concrete footing; with anchors designed for securing floor insert to floor substrate indicated; one per post standard.
1. Floor Plate: Lockable, hinged access cover, designed to be flush with adjacent flooring. Provide two tool(s) for unlocking access covers.
 - a. Basis-of-Design: Performance Sports Systems; 6430 Brass Locking Cover Plate.
 2. Floor Sleeve: Designed for use with floating and non-floating floors.
 - a. Basis-of-Design: Performance Sports Systems; 6400 3-1/2" I.D. X 10" Deep Floor Sleeve.
- D. Post Standards: Removable, paired volleyball post standards and center post standard for multicourt play as indicated. Adjustable, telescoping height. Designed for easy removal from permanently placed floor insert supports. Fabricated from extruded-aluminum pipe or tubing, with nonmarking plastic or rubber end cap or floor bumper to protect permanent flooring. Finished with manufacturer's standard factory-applied, baked powder-coating finish complying with finish manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness or plated metal finish.
1. Basis-of-Design: Performance Sports Systems; 6100 RALLYLINE Scholastic Aluminum Telescopic Competition Volleyball System.
 2. Nominal Pipe or Tubing Diameter: 3-1/2-inch OD at base.

3. Telescopic and Net Height Adjuster System: Provide infinitely adjustable system consisting of screw rod, gear, and crank or constant-tension spring and pulley assist and locking device, telescopic post, and fittings for holding net at selected height; designed for height adjustment of post standard to position net at heights indicated.
 - a. Net Heights: Adjustable between age 12 and under net height and boys'/men's volleyball net height; 72 and 100 inches or more.
 4. Height Markers: Clearly marked at regulation play heights for girls/women and boys/men.
- E. Net: 32 feet long and as follows; 1 per pair of paired post standards:
1. Basis-of-Design: Performance Sports Systems; 7602 Collegiate Volleyball Net.
 2. Width and Mesh: Competition volleyball net, 39 inches with 4-inch-square knotless mesh made of black nylon string.
 - a. Hem Band Edges: White, not less than 2-inch-wide top, bottom, and side bindings; tie offs at top, bottom and midpoint of each side end of net; end sleeves for dowels; and lines with linkage fittings threaded through top and bottom hems of binding. Provide lengths of lines and linkage fittings as required to properly connect to and set up net for post standard spacing indicated on Drawings.
 3. Dowels: Not less than 1/2-inch-diameter fiberglass or 1-inch-diameter wood. Provide two dowels per net threaded through each side hem sleeve for straightening net side edges.
 4. Net Antennas: 3/8-inch-diameter, high-tensile-strength, extruded fiberglass or plastic rods, 72 inches long, extending above top hem band of net, with alternating white and red bands according to competition rules. Provide two antennas per net.
 - a. Basis-of-Design: Performance Sports System; 6412 Volleyball Net Antenna.
 5. Boundary Tape Markers: 2-inch-wide white strip with sleeve for securing net antenna, secured to net top and bottom with hook-and-loop attachment. Provide two tape markers per net for marking court boundaries.
- F. Net Tensioning System: Designed to adjust and hold tension of net. Fully enclosed, nonslip manufacturer's standard-type winch with cable length and fittings for connecting to net lines, positive-release mechanism, and manufacturer's standard handle. Mount net tensioner on post standard at side away from court. Provide end post with post top pulley. Provide opposing post with welded steel loops, hooks, pins, or other devices for net attachment and post top grooved line guide.
- G. Bottom Net Lock Tightener: Provide manufacturer's standard quick-release-type tension strap, spring-loaded self-locking tensioner, turnbuckle, pulley, or other device and linkage fittings designed to quickly and easily tighten bottom line or net.
- H. Safety Pads: Comply with NCAA, USAV and NFHS requirements. Provide pads consisting of not less than 1-1/4-inch-thick, multiple-impact-resistant polyurethane foam filler covered by puncture- and tear-resistant, not less than 14-oz./sq. yd. nylon-reinforced PVC fabric cover; with fire-test-response characteristics indicated, and lined with fire-

retardant liner. Provide pads with hook-and-loop closure or attachments for the following components:

1. Post Standards: Wraparound style, designed to totally enclose each standard to a height of not less than 72 inches; 1 per post.
 - a. Basis-of-Design: Performance Sports System: 6010 Volleyball Standard Protective Pad. Use model 6020 for center standards as required.
 2. Fabric Cover Flame-Resistance Ratings: Passes NFPA 701.
 3. Fabric Color: As selected by Architect from manufacturer's full range.
- I. Storage Cart: Manufacturer's standard wheeled unit designed for transporting and storing volleyball equipment and passing through 36-inch-wide or wider door openings. Fabricate units of welded steel tubing with heavy-duty casters, including not less than two swivel casters. Fabricate wheels from materials that will not damage or mark floors. Provide a single cart capable of storing all components necessary for 3 volleyball courts, including uprights, pads, referee stand, nets, antennas, and balls. Provide number of carts required to support number of courts shown on Drawings.
1. Basis-of-Design: Performance Sports Systems; 6295 Volleyball Equipment Storage Cart.
- J. Referee Stand: Height adjustable platform with non-marring wheels and protective end caps on legs; with safety padding. Able to attach to net post.
1. Basis-of-Design: Performance Sports Systems; 6446 Referee Stand with 6040 Safety Padding. Color to be selected by architect from manufacturer's full range.

2.4 MULTI-SPORT CAGE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Draper Inc.
 2. Gared Sports.
 3. Jaypro Sports, LLC.
 4. Performance Sports Systems.
 5. Porter Athletic Equipment Company.
- B. Basis-of-Design: Performance Sports Systems; Model 4081 BL-70 Multi Sport Cage. Electrically operated cage including motor, cables, controls, clamps for attachment to building structure, threaded rod supports, and other components required for complete functional installation.
- C. Configuration: Rectangular shape 10 feet high by 12 feet wide by 70 feet long.
- D. Frame: Constructed of 1-5/8 inches diameter steel tubing with 0.109 inch wall thickness. Assemble frame with malleable iron galvanized fittings with case hardened set screws.
- E. Operating mechanism: Drive pipe power winch with 3/4 HP, 110VAC, 60 cycle, single-phase, reversible capacitor with thermal overload protection. Provide with load holding worm gear reducer and integral limit switches to control cage travel. Drive pipe shall rotate in pipe support assemblies.

- F. Attachment: Attach to structural support with beam clamps, hanger brackets, and 1/2 inch diameter threaded rods. Attach at 10 feet centers.
- G. Hoist lines: 1/8 inch diameter steel galvanized cable with 2,000 pounds minimum breaking strength. Space lines at approximately 10 feet.
- H. Netting:
 - 1. Type: 3/4 inch square, knotless, white, polyester mesh.
 - 2. Material: 3 strands, 1,000 denier polyester with 250 pounds breaking strength.
 - 3. Minimum weight: 0.031 pounds PSF.
 - 4. Perimeter of netting sections: Sewn with 3/8 inch polypropylene rope.
 - 5. Velcro at two corners for access to cage.
 - 6. Size netting to allow 12 inches of material to lay on floor in use position.

2.5 GROUP CONTROLLER

- A. Group Controller: Programmable touch pad system for operation of all electrical devices in this section and in section 11 66 53 "Gymnasium Dividers."
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Draper Inc.
 - 2. Gared Sports.
 - 3. Jaypro Sports, LLC.
 - 4. Performance Sports Systems.
 - 5. Porter Athletic Equipment Company.
- C. Basis-of-Design Product: Performance Sports Systems; model TSC1500.
 - 1. Provide quantity of controllers required to operate all equipment, including divider curtains, from 2 stations within the Competition/Field House space.

2.6 SAFETY PADS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Draper Inc.
 - 2. Gared Sports.
 - 3. Jaypro Sports, LLC.
 - 4. Performance Sports Systems.
 - 5. Porter Athletic Equipment Company.
- B. Basis-of-Design Product: Performance Sports Systems; 4110 Wall Pad, with 4196 Z-Clip wall attachment kits.
- C. Pad Coverings: Provide safety pad fabric covering fabricated from puncture- and tear-resistant, not less than 14-oz./sq. yd PVC-coated polyester or nylon-reinforced PVC fabric treated with fungicide for mildew resistance; with surface-burning characteristics indicated.

- D. Wall Safety Pads: Padded wall wainscot panels designed to be attached in a continuous row; each panel section consisting of fill laminated to backer board with visible surfaces fully covered by seamless fabric covering, free of sag and wrinkles and firmly attached to back of backer board.
1. Backer Board: Not less than 3/8-inch-thick plywood, mat formed, or composite panel.
 2. Fill: Multiple-impact-resistant foam not less than 2-inch-thick polyurethane, 3.5-lb/cu. ft. density .
 3. Size: Achieve 5 equal width wall panels per precast panel; roughly 2'-3 1/2" wide by 6'-0" tall.
 4. Number of Panel Sections: As indicated, modular panel sections.
 5. Installation Method: Concealed mounting Z-clips.
 6. Fabric Covering Color(s): As selected by Architect from manufacturer's full range for two color(s).
 7. Graphics: Custom graphics as indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for play court layout, alignment of mounting substrates, installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance.
1. Verify critical dimensions.
 2. Examine supporting structure and subfloors and footings below finished floor.
 3. Examine wall assemblies, where reinforced to receive anchors and fasteners, to verify that locations of concealed reinforcements have been clearly marked. Locate reinforcements and mark locations.
 4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Comply with manufacturer's written installation instructions and competition rules indicated for each type of gymnasium equipment. Complete equipment field assembly, where required.
- B. Unless otherwise indicated, install gymnasium equipment after other finishing operations, including painting, have been completed.
- C. Permanently Placed Gymnasium Equipment and Components: Rigid, level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated on Shop Drawings; in proper relation to adjacent construction; and aligned with court layout.
1. Floor Insert Location: Coordinate location with application of game lines and markers, and core drill floor for inserts after game lines have been applied.
 2. Floor Insert Elevation: Coordinate installed heights of floor insert with installation and field finishing of finish flooring and type of floor plate.

3. Operating Gymnasium Equipment: Verify clearances for movable components of gymnasium equipment throughout entire range of operation and for access to operating components.
 - D. Floor Insert Setting: Position sleeve in oversized, recessed voids in concrete slabs. Clean voids of debris. Fill void around sleeves with grout, mixed and placed to comply with grout manufacturer's written instructions. Protect portion of sleeve above subfloor from splatter. Verify that sleeves are set plumb, aligned, and at correct height and spacing; hold in position during placement and finishing operations until grout is sufficiently cured. Set insert so top surface of completed unit is flush with finished flooring surface.
 - E. Wall Safety Pads: Mount with bottom edge at 6 inches above finished floor.
 - F. Anchoring to In-Place Construction: Use anchors and fasteners where necessary for securing built-in and permanently placed gymnasium equipment to structural support and for properly transferring load to in-place construction.
 - G. Connections: Connect automatic operators to building electrical system.
 - H. Removable Gymnasium Equipment and Components: Assemble in place to verify that equipment and components are complete and in proper working order. Instruct Owner's designated personnel in properly handling, assembling, adjusting, disassembling, transporting, storing, and maintaining units. Disassemble removable gymnasium equipment after assembled configuration has been approved by Owner, and store units in location indicated on Drawings.

3.3 ADJUSTING

- A. Adjust movable components of gymnasium equipment to operate safely, smoothly, easily, and quietly, free from binding, warp, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and moving parts.

3.4 CLEANING

- A. After completing gymnasium equipment installation, inspect components. Remove spots, dirt, and debris and touch up damaged shop-applied finishes according to manufacturer's written instructions.
- B. Replace gymnasium equipment and finishes that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain gymnasium equipment. Refer to Section 01 79 00 "Demonstration and Training."

END OF SECTION 11 66 23

SECTION 11 66 43 - INTERIOR ELECTRONIC SCOREBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: Interior, electronic, multi-sport multi-purpose basketball/volleyball scoreboards including control center and other accessories for complete functional installation.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM) Publications.
- B. ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.
- C. National Electrical Code.
- D. Federal Communications Commission, Part 15 Rules & Regulations.
- E. UL and C-UL Standard for Electric Signs.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, including scoreboards, controls, and accessories. Include descriptions of control functions.
- B. Shop Drawings: Include installation drawings, face layout, dimensions, construction, electrical wiring diagrams, and method of anchorage.
- C. Samples for Initial Selection: Finish Samples, minimum 6 by 6 inches, for each type of product indicated.

1.4 QUALITY ASSURANCE

- A. Source limitation: Obtain each type of product, and all components including scoreboard, control center, control cable, and other accessories and installation hardware, from single source from single manufacturer.
- B. Manufacturer qualifications: Company specializing in manufacturing electronic scoreboards with 10 years minimum experience.
- C. Scoreboards and other electrical components shall be certified for use in United States by Underwriter Laboratories, (UL), Inc. and shall bear UL Label.
- D. Scoreboards and other electrical components shall be electrically grounded in accordance with National Electrical Code (NEC), Article 600.

1.5 WARRANTY

- A. Manufacturer's Warranty: Guarantee to cover defects in materials and workmanship.
 - 1. 5 years parts and factory labor guarantee for scoreboards, wired controls, and accessories.
 - 2. 2 years part and factory labor guarantee for wireless controls and receivers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Nevco Inc. or a comparable product by manufacturers including, but not limited to, the following:
 - 1. Everbrite, LLC.
 - 2. Gared Sports.
 - 3. Performance Sports Systems.
 - 4. Scoreboards Plus Inc.
 - 5. White Way Sign Co.

2.2 MATERIALS

- A. Aluminum face and perimeter frame: Fabricated from minimum 0.050 inch thickness, ASTM B221 aluminum sheet.
- B. Finish: Acrylic polyurethane paint. Color as selected by Architect from manufacturer's standard range.
- C. Electronics: Low voltage, solid state, 2-wire cable, multiplex system, quartz crystal controlled.
 - 1. Provide fiber optic communication interface to reduce threat of damage from electrical storms.
- D. LED (light emitting diode) units: Seven-bar, segmented digits in protective aluminum cover, rated typical life 100,000 hours, and designed to provide excellent visibility from all angles and sides.
- E. Provide location specific universal power cord with plug.
- F. Control cable where required shall be UL listed, 2-wire, type RG-58/U, coaxial cable, 1/4 inch diameter.
- G. Junction boxes where required: Sheet metal box & cover, 4-1/2 x 2-1/8 x 2-1/8 inches min. complying w/ NEMA standards.

2.3 SCOREBOARDS

A. Scoreboard, Type 1: For use at competition basketball court; 2 total.

1. Basis-of-Design Product: Model 2750-NL (Non-Lit caption.)
2. Type: Interior, multi-purpose basketball/volleyball electronic scoreboard with two integral horns, changeable captions and LED displays for time, scores, period, number of player fouling w/ personal fouls, team fouls, bonus and double bonus indicators, and next possession arrows. No captions shall be applied directly to the face of the scoreboard. All caption plates will be changeable and made of polyvinylchloride with vinyl lettering applied.
 - a. Size: 8 feet long x 6 feet high x 8 inches deep.
 - b. Approximate hanging weight: 130 pounds.
 - c. Captions: 6 inches high:
 - 1) Basic: "Home", "Guests" and "Period".
 - 2) Basketball: "Fouls" and "Player".
 - 3) Volleyball: "Won" and "Game".
 - d. LED displays:
 - 1) Timing: Super Bright Red 13 inches high digits with lit colon.
 - 2) Team scores: Super Bright Amber 13 inches high digits.
 - 3) Period: Super Bright Amber 9 inches high digits.
 - 4) Player number with personal fouls, game, and weight: Super Bright Red 9 inches high digits.
 - 5) Team fouls, games won, and match: Super Bright Amber 9 inches high digits.
 - 6) Next possession: Super Bright Amber arrow for each team.
 - 7) Include bonus and double bonus in the form of a 4 inch Super Bright Red LED "B".
 - e. Provide Advertising /Team logo area, 3 each, 12" x 12" minimum.
 - f. Wall mounting attachments will be included for 1 location. Second location shall be mounted to side-folding, side-braced backstop.
 - g. Power requirement: All options included: 158 Watts, MAX, 100-240 Volts AC w/ Power Factor Correction.
 - h. Provide each scoreboard or accessory with control cable of length required. Electrical junction boxes, conduits, mounting hardware and other accessories as required for installation are to be provided by others.
3. Accessories:
 - a. Shot Clock system: For main competition basketball court; model SCD-7A.
 - b. Stat Panels: Capable of showing player number, points, and fouls for 5 team members, and showing number of time outs left; model SD7-5. Include header section with "Home" and "Guests" captions.

B. Scoreboard, Type 2: For use at practice basketball court; 4 total.

1. Basis-of-Design Product: Model 2700-NL (Non-Lit caption.)

2. Type: Interior, multi-purpose basketball/volleyball electronic scoreboard with two integral horns, LED displays for time, scores, period, bonus and double bonus indicators, and next possession arrows. No captions shall be applied directly to the face of the scoreboard. All caption plates will be changeable and made of polyvinylchloride with vinyl lettering applied.
 - a. Size: 8 feet long x 3 feet high x 8 inches deep.
 - b. Approximate hanging weight: 71 pounds.
 - c. Captions: 6 inches high:
 - 1) Basic: "Home", "Guests" and "Period".
 - d. LED displays:
 - 1) Timing: Super Bright Red 13 inches high digits with lit colon.
 - 2) Team scores: Super Bright Amber 13 inches high digits.
 - 3) Period: Super Bright Amber 9 inches high digits.
 - 4) Next possession: Super Bright Amber arrow for each team.
 - 5) Include bonus and double bonus in the form of a 4 inch Super Bright Red LED "B".
 - e. Provide Advertising /Team logo area, 12" x 12" minimum.
 - f. Wall mounting attachments shall be included.
 - g. Power requirement: All options included: 126 Watts, MAX, 100-240 Volts AC w/ Power Factor Correction.
 - h. Provide each scoreboard or accessory with control cable of length required. Electrical junction boxes, conduits, mounting hardware and other accessories as required for installation are to be provided by others.

2.4 CONTROL CENTER

- A. Type: Wireless, microprocessor based, operator's control center with receiver unit mounted at scoreboard and designed to operate different models of scoreboard by interchange of keyboard overlay; Model MPCW.
 1. Unit shall comply with Part 15 of FCC Rules regarding interference.
 2. Console: High impact, break-resistant gray plastic, 11 x 9-1/2 x 4-1/8 inches.
 3. Features:
 - a. Provide with multiple scoreboard operation.
 - b. Power on-off switch.
 - c. Split and raised 40 key keyboards, internal beeper acknowledging each entry, and bookmark capabilities.
 - d. Keyboard overlays for scoreboard or accessory.
 - e. Remote hand-held main time switch with integral horn button.
 - f. Provide with LED displays, lithium cell battery backup to maintain scoreboard memory and time of day, self test mode, power on-off switch, alternate time control.
 - g. Timer features: Time of day display, multiple time out timers with warning, interval horn, upcount auto stop with horn, and 1/10th second display during last minute.
 - h. Dimmer control for scoreboard.
 4. Receiver: Sturdy impact resistant construction, 6 x 4 x 1.5 inches with 4 inch

- antenna and mounted at scoreboard.
- 5. Maximum range: 1,000 feet from control center to receiver.
- 6. Power adapters: Provide for each control center.
 - a. Input: 120 volts, 0.4 amps, 50/60 Hz.
 - b. Output: 9 volts, 1.67 amps, 15 watts.
- 7. Provide option of battery supply for control operation if utility power not available.
- 8. Provide carrying case for control center and hand-held switch; Model CC-3.
 - a. Size: 18-1/2 x 14-1/2 x 6 inches.
 - b. Construction: Double wall, high density black polyethylene with padded interior, mechanical latches, and hinges.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate scoreboard and control center receiver quantities and junction box locations with Architect and precast panel manufacturer.
- B. Coordinate requirements for electrical power, wall blocking, auxiliary framing & supports, suspension cables and other components to be provided under other Specification Sections to ensure adequate provisions are made for complete, functional installation of scoreboards. Ensure that building roof structure has been designed for loads of suspended scoreboards.
- C. Coordinate scoreboard electrical requirements to ensure proper power source, conduit, wiring and boxes are provided. Prior to installation, verify type and location of power supply.

3.2 INSTALLATION

- A. Install scoreboards and accessories in accordance with manufacturer's instructions and approved installation drawings.
- B. Before install field test scoreboards & accessories for operating functions. Ensure that scoreboards accurately perform all operations. Correct deficiencies.
- C. Rigidly mount scoreboards and accessories level and plumb with brackets and fasteners.
- D. Clean exposed surfaces.
- E. Protect scoreboards and finishes from other construction operations.

3.3 DEMONSTRATING AND TRAINING

- A. Provide demonstration and training session for Owner's representative covering operation and maintenance of electronic scoreboard.

END OF SECTION 11 66 43

SECTION 11 66 53 - GYMNASIUM DIVIDERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes:
 - 1. Gymnasium divider curtains.
- B. Related Sections:
 - 1. Section 11 66 23 "Gymnasium Equipment": For programmable touch pad system for operation of all electrical devices in section 11 66 23 "Gymnasium Equipment" and section '11 66 53 "Gymnasium Dividers."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. If applicable, include assembly, disassembly, and storage instructions for removable equipment.
 - 2. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Samples for Verification: For divider curtain fabric, not less than 12 inches square of open mesh , and of opaque fabric.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For gymnasium dividers to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain each type of gymnasium divider, and gymnasium equipment specified in section 11 66 23, through a single source from single manufacturer.

- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install gymnasium dividers until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Verify position for gymnasium dividers.

1.7 COORDINATION

- A. Coordinate installation of overhead-supported gymnasium dividers and suspension system components with other construction including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of gymnasium dividers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, faulty operation of gymnasium dividers.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Extruded Bars, Profiles, and Tubes: ASTM B 221.
 - 2. Cast Aluminum: ASTM B 179.
 - 3. Flat Sheet: ASTM B 209.
- B. Steel: Comply with the following:
 - 1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - 2. Steel Tubing: ASTM A 500 or ASTM A 513, cold formed.
 - 3. Steel Sheet: ASTM A 1011/A 1011M.
- C. Support Cable: Manufacturer's standard galvanized steel aircraft cable with a breaking strength of 7000 lb. Provide fittings complying with cable manufacturer's written instructions for size, number, and method of installation.

- D. Castings and Hangers: Malleable iron, ASTM A 47/A 47M, grade required for structural loading.
- E. Anchors, Fasteners, Fittings and Hardware: Manufacturer's standard corrosion-resistant or noncorrodible units; concealed; tamperproof, vandal- and theft-resistant design.

2.2 DIVIDER CURTAINS

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

1. Draper Inc.
2. Jaypro Sports, LLC.
3. Performance Sports Systems.
4. Porter Athletic Equipment Co.

- C. Basis-of-Design Product:

1. Divider Curtain, Type A: Performance Sports Systems; 4050 Center Drive Gym Divider Curtain.
2. Divider Curtain, Type B: Performance Sports Systems; Gym Divider Curtain model that will allow full height vinyl material, with custom graphic to be supplied by architect.

- D. Divider Curtains: Electrically operated, fold up or roll up, and as follows:

1. Upper Curtain, Mesh: Woven fabric of 100 percent polyester yarn coated with PVC weighing not less than minimum 6.5 oz./sq. yd.
 - a. Mesh Color: White.
2. Lower Curtain, Solid: Woven polyester coated with PVC, minimum 18 oz./sq. yd, embossed, approximately 8'-8" height above floor (align with top of bleachers.)
 - a. Fabric Color(s): As selected by Architect from manufacturer's full range.
3. Divider Curtain Flame-Resistance Ratings: Passes NFPA 701, inherently and permanently flame resistant.
 - a. Permanently attach label to each fabric of curtain assembly indicating whether fabric is inherently and permanently flame resistant or treated with flame-retardant chemicals, and whether it will require retreatment after designated time period or cleaning.

- E. Curtain Fabrication: Fused seams and the following:

1. Top Hem: Reinforce with double thickness mesh for grommets.
2. Bottom Hem for Fold-up Curtains: Floor-length curtains with hems 2 inches above finished floor and with manufacturer's standard pipe batten with felt padding in pocket.
3. Bottom Hem for Roll-up Curtains: Floor-length curtains with hems 2 inches above finished floor and with manufacturer's standard 3-1/2- to 4-inch roll-up tube and lifting tape.

4. Bottom Hem for Draw Curtains: Floor-length curtains with hems 2 inches above finished floor with proof coil chain in pocket.
- F. Accessories:
1. Grommets: Manufacturer's standard size and spacing, for snaps or S-hooks.
 2. Curtain Battens: Fabricate battens from steel pipe with a minimum number of joints. As necessary for required lengths, connect pipe with drive-fit pipe sleeve not less than 18 inches long, and secure with 4 flush rivets, plug welds, threaded couplings, or another equally secure method. Shop-paint completed pipe battens with black paint.
 - a. Steel Pipe: ASTM A 53/ A 53M, Grade A, standard weight (Schedule 40), black, 1-1/2-inch nominal diameter, unless otherwise indicated.
- G. Divider Curtain Operator: Roll-up drive tube or Upward folding, cable suspended.
- H. Divider Curtain Electric Operator: Provide operating machine of size and capacity recommended by manufacturer for equipment specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, and remote controls. Coordinate wiring requirements and electrical characteristics with building electrical system.
1. Operator Type: Electric motor, worm-gear running-in-oil drive, with chain and sprocket secondary drive.
 2. Motor Characteristics: Sufficient to start, accelerate, reverse, and operate connected loads at designated speeds within installed environment and with indicated operating sequence, and without exceeding nameplate rating or considering service factor. Comply with NEMA MG 1, and the following:
 3. Voltage: 120 V.
 4. Horsepower: 1 hp.
 5. Enclosure: Manufacturer's standard.
 6. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3300 feet above sea level.
 7. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.
 8. Phase: One.
 9. Remote Control Station: See section 11 66 23 "Gymnasium Equipment" for programmable touch pad system for operation of all electrical devices in section 11 66 23 "Gymnasium Equipment" and section 11 66 53 "Gymnasium Dividers."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for alignment of mounting substrates, installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance.
1. Verify critical dimensions.
 2. Examine supporting structure.
 3. Examine wall assemblies, where reinforced to receive anchors and fasteners, to verify that locations of concealed reinforcements have been clearly marked. Locate reinforcements and mark locations.

4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Comply with manufacturer's written installation instructions. Complete field assembly, where required.
- B. Unless otherwise indicated, install gymnasium dividers after other finishing operations, including painting, have been completed.
- C. Gymnasium Dividers, and Components: Rigid, level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated on Shop Drawings; in proper relation to adjacent construction; and aligned with court layout.
 1. Verify clearances for movable components of gymnasium dividers throughout entire range of operation and for access to operating components.
- D. Anchoring to In-Place Construction: Use anchors and fasteners where necessary for securing gymnasium dividers to structural support and for properly transferring load to in-place construction.
- E. Connections: Connect automatic operators to building electrical system.

3.3 ADJUSTING

- A. Adjust movable components of gymnasium dividers to operate safely, smoothly, easily, and quietly, free from binding, warp, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and moving parts.

3.4 CLEANING

- A. After completing gymnasium divider installation, inspect components. Remove spots, dirt, and debris and touch up damaged shop-applied finishes according to manufacturer's written instructions.
- B. Replace gymnasium divider components and finishes that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain gymnasium dividers. Refer to Section 01 79 00 "Demonstration and Training."

END OF SECTION 11 66 53

SECTION 12 22 00 - CURTAINS AND DRAPES

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 draperies and drapery tracks.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Tracks: Include maximum weights of draperies that can be supported.
 - 2. Fabrics and textile treatments.
- B. Shop Drawings:
 - 1. Tracks: Show installation and anchorage details and locations of controls.
 - 2. Draperies: Show sizes, locations, and details of installation.
- C. Samples for Verification: As follows:
 - 1. Tracks: 18 inches long, with carriers, controls, and accessories.
 - 2. Textile Trims: For each color and pattern indicated, 18 inches long.
- D. Product Schedule: For draperies and drapery tracks. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: For track installation; reflected ceiling plans drawn to scale and coordinating track installation with openings and ceiling-mounted items. Show the following:
 - 1. Suspended ceiling components.
- B. Product Certificates: For each fabric treated with flame retardant, signed by fabric supplier and indicating treatment durability and cleaning procedures required to maintain treatment effectiveness.

1.5 CLOSEOUT SUBMITTAL

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

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: For draperies and tracks, fabricator of draperies.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions by field measurements before drapery fabrication, and indicate measurements on Shop Drawings.
- B. Scheduling: Do not deliver or install draperies until after other finish work, including painting, is complete and spaces are otherwise ready for occupancy.

PART 2 - PRODUCTS

2.1 DRAPERY TRACKS

- A. Manually Operated Track :
 - 1. Manufacturers: Subject to compliance with requirements, provide Forest Group USA, Inc.; Type CS-Contract System, or comparable product by one of the following:
 - a. Kirsch.
 - b. Silent Gliss USA Inc.
 - c. Springs Window Fashions.
 - 2. Construction: Extruded aluminum, slotted for mounting at interval of not more than 24 inches o.c.
 - a. Lengths and Configurations: As indicated on Drawings.
 - b. Support Capability: Weight of drapery indicated mounted on track length indicated.
 - c. Finish: Clear anodic coating.
 - 3. Mounting Brackets: Aluminum, of type suitable for fastening track to surface indicated and designed to support weight of track assembly and drapery plus force applied to operate track.
 - a. Mounting Surface: Ceiling .
 - b. Size: Adjustable.
 - 4. Installation Fasteners: Sized to support track assembly and drapery, and fabricated from metal compatible with track, brackets, and supporting construction. Provide two fasteners to fasten each bracket to supporting

- 5. construction.
Operation: Baton .
 - a. Draw: Two way, center opening.
 - b. Operating Hardware Location: On stack side.
- 6. Carriers: Rollers .
 - a. Master Carriers: Butt.
- 7. End Stops: Manufacturer's standard with track end cap.
- 8. Pulleys: Heavy duty.

2.2 DRAPERIES

- A. Fire-Test-Response Characteristics: For fabrics treated with fire retardants, provide products that pass NFPA 701 as determined by testing of fabrics that were treated using treatment-application method intended for use for this Project by a testing and inspecting agency acceptable to authorities having jurisdiction.
- B. Source Limitations: Obtain each color and pattern of drapery fabric and trim from one dye lot.
- C. Drapery:
 - 1. Heading: Provide ripplefold curtain in 200% fullness.
 - 2. Drapery Fabric:
 - a. Manufacturer: Knoll.
 - b. Pattern: Wonder C1924/10.
 - c. Color: Tent.
 - d. Orientation: Run right (up the bolt).
 - e. Textile Treatments: Flame retardant, polymer type.
 - 3. Lining Fabric:
 - a. Lining Type: Blackout.
 - b. Manufacturer: Selected by fabricator for use with drapery fabric indicated.
 - c. Textile Treatments: Flame retardant, polymer type.
 - 4. Hem Weights: Tape type (string weights).

2.3 DRAPERY FABRICATION

- A. Fabricate draperies in heading styles and fullnesses indicated. Fabricate headings to stand erect. If less than a full width of fabric is required to produce panel of specified fullness, use equal widths of not less than one-half width of fabric located at ends of panel.
 - 1. Center-Opening Draperies: Add 10 inches to overall width for overlap.

- B. Seams: Sew vertical seams with twin-needle sewing machine with selvage trimmed and overlocked. Join widths so that patterns match and vertical seams lay flat and straight without puckering. Horizontal seams are not acceptable.
- C. Side Hems: Double-turned, 1-1/2-inch- wide hems consisting of three layers of fabric, and blindstitched so that stitches are not visible on face of drapery.
- D. Bottom Hems: Double-turned, 4-inch- wide hems consisting of three layers of fabric, and weighted and blindstitched so that weights and stitches are not visible on face of drapery.
- E. Linings: Equal to widths of drapery fabric and joined to drapery fabric at top by inside invisible seam, and hand stitched at side hems and shadowed with 1-1/2-inch return of face fabric.
 - 1. Bottom Hem: Hem separately from drapery fabric.

PART 3 - EXECUTION

3.1 DRAPERY TRACK INSTALLATION

- A. Install track systems according to manufacturer's written instructions, level and plumb, and at height and location in relation to adjoining openings as indicated on Drawings.

3.2 DRAPERY INSTALLATION

- A. Where draperies abut overhead construction, hang draperies so that clearance between headings and overhead construction is 1/4 inch.
- B. Where draperies extend to floor, install so that bottom hems clear finished floor by not more than 1 inch and not less than 1/2 inch.

3.3 ADJUSTING

- A. After hanging draperies, test and adjust each track to produce unencumbered, smooth operation.
- B. Steam and dress down draperies as required to produce crease- and wrinkle-free installation.
- C. Remove and replace draperies that are stained or soiled.

END OF SECTION 12 22 00

SECTION 12 24 13 - ROLLER WINDOW SHADES

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. Manually operated roller shades with single rollers .

- B. Related Requirements:

- 1. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.
- 2. Section 07 92 00 "Joint Sealants" for sealing the perimeters of installation accessories for light-blocking shades with a sealant.

1.3 ACTION SUBMITTALS

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

- 1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

- B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

- C. Samples: For each exposed product and for each color and texture specified, 10 inches long.

- D. Samples for Initial Selection: For each type and color of shadeband material.

- 1. Include Samples of accessories involving color selection.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roller shades to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Draper Inc.
 - 2. Hunter Douglas Contract.
 - 3. Lutron Electronics Co., Inc.
 - 4. MechoShade Systems, Inc.
- B. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

- A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
 - 1. Bead Chains: Manufacturer's standard.
 - a. Loop Length: Full length of roller shade .
 - b. Limit Stops: Provide upper and lower ball stops.
 - c. Chain-Retainer Type: Chain tensioner, jamb mounted.
 - 2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller-shade weight and lifting heavy roller shades.
 - a. Provide for shadebands that weigh more than 10 lb or for shades as

recommended by manufacturer, whichever criteria are more stringent.

- B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
 - 1. Roller Drive-End Location: Right side of inside face of shade.
 - 2. Direction of Shadeband Roll: Regular, from back of roller.
 - 3. Shadeband-to-Roller Attachment: Manufacturer's standard method.
- C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- D. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.
- E. Shadebands:
 - 1. Shadeband Material: Light-filtering fabric and Light-blocking fabric .
 - 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Enclosed in sealed pocket of shadeband material.
 - b. Color and Finish: As selected by Architect from manufacturer's full range.
- F. Installation Accessories:
 - 1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
 - a. Shape: L-shaped.
 - b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open, but not less than 3 inches.
 - 2. Endcap Covers: To cover exposed endcaps.
 - 3. Recessed Shade Pocket: Rectangular, extruded-aluminum enclosure designed for recessed ceiling installation; with front, top, and back formed as one piece, end plates, and removable bottom closure panel.
 - a. Height: Manufacturer's standard height required to enclose roller and shadeband when shade is fully open, but not less than 4 inches.
 - b. Provide pocket with lip at lower edge to support acoustical ceiling panel.
 - 4. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.
 - 1. Source: Roller-shade manufacturer.
 - 2. Weave: 2x2 Basketweave.
 - 3. Roll Width: As required to provide a seamless shadeband .
 - 4. Orientation on Shadeband: Up the bolt .
 - 5. Openness Factor: 1 percent.
 - 6. Color: As selected by Architect from manufacturer's full range.
- C. Light-Blocking Fabric: Opaque fabric, stain and fade resistant.
 - 1. Source: Roller-shade manufacturer.
 - 2. Roll Width: As required to provide a seamless shadeband .
 - 3. Orientation on Shadeband: Up the bolt .
 - 4. Features: Washable.
 - 5. Color: As selected by Architect from manufacturer's full range.

2.4 ROLLER-SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:
 - 1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.
 - 2. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:
 - 1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER-SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
 - 1. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

3.3 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

- A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

3.6 ROLLER SHADE SCHEDULE

- A. Type 1: Manually operated roller shade with light filtering shadeband; inside jamb at single windows, outside jamb at multiple window spans.
- B. Type 2: Manually operated roller shade with light blocking shadeband; with recessed shade pocket.

END OF SECTION 12 24 13

SECTION 12 36 23.13 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

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 plastic-laminate countertops.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product, including adhesive for bonding plastic laminate.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
 - 2. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project, cost for each regional material, and fraction by weight that is considered regional.
 - 3. Product Data for Credit IEQ 4.1: For installation adhesives, including printed statement of VOC content.
 - 4. Product Data for Credit IEQ 4.4: For adhesives and composite wood products, documentation indicating that products contain no urea formaldehyde.
- C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show locations and sizes of cutouts and holes for plumbing fixtures, electrical switches and outlets and other items installed in plastic-laminate countertops.
- D. Samples for Verification:
 - 1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish.
 - 2. Wood-grain plastic laminates, 8 by 10 inches, for each type, pattern and surface finish.

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 or Certified participant in AWI's Quality Certification Program..

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver countertops until painting and similar operations that could damage countertops have been completed in installation areas. If countertops 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 countertops until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55percent during the remainder of the construction period.
- B. Field Measurements: Where countertops 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.
- C. Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where countertops are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE COUNTERTOPS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades indicated for construction, 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. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGP.
 - 1. See "Millwork Finish Types" legend on Drawings for product information.
- D. Edge Treatment: Provide the following where indicated on Drawings.
 - 1. Same as laminate cladding on horizontal surfaces.
 - 2. Vinyl T-moulding, flat face.

- 3. 3-mm PVC edging.
- E. Core Material: Particleboard or medium-density fiberboard.
- F. Core Material at Sinks: Particleboard made with exterior glue or exterior-grade plywood.
- G. Core Thickness: 3/4 inch.
 - 1. Build up countertop thickness to 1-1/2 inches at front, back, and ends with additional layers of core material laminated to top.

2.2 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard 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. Recycled Content of Medium-Density Fiberboard and Particleboard: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
 - 2. Medium-Density Fiberboard: ANSI A208.2, Grade 130 , made with binder containing no urea formaldehyde.
 - 3. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde.
 - 4. Softwood Plywood: DOC PS 1.

2.3 ACCESSORIES

- A. Grommets for Cable Passage through Countertops: 2-1/2 inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.
 - 1. Product: Subject to compliance with requirements, provide "EDP series" by Doug Mockett & Company, Inc.

2.4 MISCELLANEOUS MATERIALS

- A. Adhesives: Do not use adhesives that contain urea formaldehyde.
- B. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
 - 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.
- C. VOC Limits for Installation Adhesives and Sealants: Use products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Wood Glues: 30 g/L.
2. Multipurpose Construction Adhesives: 70 g/L.
3. Structural Wood Member Adhesive: 140 g/L.
4. Architectural Sealants: 250 g/L.

2.5 FABRICATION

- A. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets. Ease edges to radius indicated for the following:
 1. Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
- B. Complete fabrication, including assembly, 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. 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 appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
 1. Seal edges of openings in countertops with a coat of varnish.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.
- B. Before installing countertops, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

- A. Grade: Install countertops to comply with same grade as item to be installed.
- B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.
 1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items.

2. Seal edges of cutouts by saturating with varnish.
- C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
1. Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.
- D. Install countertops 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.
- E. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- F. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
1. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 2. Secure backsplashes to walls with adhesive.
 3. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean countertops on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 12 36 23.13

SECTION 12 36 61 - SIMULATED STONE COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Solid-surface-material countertops and backsplashes.
 - 2. Prefabricated lavatory decks.

1.3 ACTION SUBMITTALS

- A. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
 - 2. Product Data for Credit IEQ 4.4: For adhesives and composite wood products, documentation indicating that product contains no urea formaldehyde.
- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
- C. Samples for Verification: For the following products:
 - 1. Countertop material, 6 inches square.

1.4 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions of countertops by field measurements before countertop fabrication is complete.

1.5 COORDINATION

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID-SURFACE-MATERIAL COUNTERTOPS

- A. Configuration: Provide countertops with the following front and backsplash style:
 - 1. Front: Straight, slightly eased at top .
 - 2. Backsplash: Straight, slightly eased at corner .
 - 3. Endsplash: Matching backsplash.
- B. Countertops: 1/2-inch- thick, solid surface material with front edge built up with same material.
- C. Backsplashes: 1/2-inch- thick, solid surface material.
- D. Fabrication: Fabricate tops in one piece with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid-surface-material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
 - 1. Fabricate with loose backsplashes for field assembly.

2.2 COUNTERTOP MATERIALS

- A. Particleboard: ANSI A208.1, , made with binder containing no urea formaldehyde.
 - 1. Recycled Content: Not less than 25 percent preconsumer or postconsumer recycled content.
- B. Adhesives: Adhesives shall not contain urea formaldehyde.
- C. Solid Surface Material: Homogeneous solid sheets of filled plastic resin complying with ANSI SS1.
 - 1. Type ES-1: Ceasarstone; 1141.
 - 2. Type SS-1: Meganite; Ebony Granite 710.
 - 3. Type SS-2: Meganite; Bright White 001.

2.3 PREFABRICATED LAVATORY DECK

- A. Product: Bradley Corp.; OmniDeck LD-3010 in TerreonRE, color Charcoal Grey; with SL-TR1 undermountbowls, color Designer White; with standard stainless steel surface mount brackets.
 - 1. Provide number of bowls as shown on Drawings.
 - 2. Provide with single-station trap covers at each bowl.
 - 3. Seam units that exceed 120 inches in total length.
 - 4. Provide with 5 inch front apron and 2 inch backsplashand sidesplashes.
 - 5. Provide with strainers. Refer to Plumbing Drawings for associated faucet, drain, and trim.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet.
- B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Pre-drill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
 - 1. Install backsplashes and endsplashes to comply with manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
 - 2. Seal edges of cutouts in particleboard subtops by saturating with varnish.

END OF SECTION 12 36 61

SECTION 12 66 00 - TELESCOPING STANDS

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-attached telescoping stands.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design telescoping stands, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Telescoping stands shall withstand the effects of gravity loads and loads and stresses within limits and under conditions indicated according to ICC 300 NFPA 102.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for telescoping stands.
- B. Shop Drawings: For telescoping stands in both stacked and extended positions. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Wiring Diagrams: For power, signal, and control wiring.
- C. Samples for Initial Selection: For units with factory-applied finishes.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
 - 1. Decking: 6-inch-square Samples of finished material.
 - 2. Metal Components: 6-inch-square Sample of each color and finish indicated.
 - 3. Seating: 6-inch-square Sample of each seating material, color, and finish indicated.
 - 4. Signage: Full-size units for row letters, seat numbers, each type of accessibility sign, and custom graphics.

- E. Delegated-Design Submittal: For telescoping stands 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. Qualification Data: For qualified Installer.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For telescoping stands to include in operation and maintenance manuals.
 - 1. Precautions for cleaning materials and methods that could be detrimental to telescoping stand finishes and performance.

1.7 QUALITY ASSURANCE

A. Bidder Qualification

- 1. Bidders are required to be an authorized dealer or manufacturer for equipment proposed which on a day-to-day basis regularly provide the equipment offered. Bidders are further advised that only standard production models or standard options will be acceptable for award. Equipment offered shall be currently manufactured on an active assembly line. The Owner is only interested in proven equipment; provided, installed, and serviced by Authorized Dealers capable of providing references
- 2. Along with bid, bidders must submit a detailed telescoping gym seat assembly layout. Show seat heights, row spacing and rise, aisle widths, open/close dimensions and ADA locations. Total net seats must be indicated on drawings

B. Installer Qualifications

- 1. Bleacher installer shall be Factory Certified by the Manufacturer. Proof of Factory Certified Installation Certificate shall be provided along with the Invitation to Bid. Failure to provide this information shall result in rejection of bid.

C. Service Capability:

- 1. The Bleacher Contractor must be able to show proof of full time service capability by factory certified technicians directly employed by the Bleacher Contractor. Adequate and satisfactory availability of repair parts and supplies, and ability to meet warranty and service requirements are a requirement of this Invitation to Bid. The Owner reserves the right to satisfy itself by inquiry or otherwise as to bidder's capabilities in this regard. A four (4) to eight (8) hour maximum on-site repair response is required during normal working hours, 8 a.m. to 5 p.m. weekdays (excluding holidays) All Full Time Service Personnel shall be Factory Authorized and Trained. Proof of Service Capability along with a listing of service parts regularly maintained in inventory shall be provided by the successful contractor. Failure to provide this information may result in rejection of bid.

- D. 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.
- E. Standard: Provide telescoping stands to comply with ICC 300 and NFPA 102.
- F. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
- G. Preinstallation Conference: Conduct conference at Project site.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of stands that fail in materials or workmanship within specified warranty period. Manufacturer will also provide all yearly inspections required to comply with ICC 300 and NFPA 102 within specified warranty period.
 - 1. Warranty Period: Five years from the date of Substantial Completion.

1.9 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings and construction contiguous with telescoping stands by field measurements before fabrication. Verify locations of walls, columns, and other construction that will interface with operating telescoping stands.
- B. Coordinate quantity, size, and location of cutouts required for installation of electrical devices at first row seating as indicated on Drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Wood:
 - 1. Plywood: APA-grade trademarked, DOC PS 1.
- B. Steel:
 - 1. Structural-Steel Shapes, Plates, and Bars: ASTM A 36/A 36M.
 - 2. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90coating designation.
 - 3. Uncoated Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold-rolled commercial steel), or ASTM A 1011/A 1011M, Designation CS (hot-rolled commercial steel).
 - 4. Tubing: ASTM A 500, cold formed; ASTM A 501, hot formed; or ASTM A 513, mechanical.
- C. Extruded Aluminum: ASTM B 221, alloy as standard for manufacturer.

- D. Polyethylene Plastic: High-density polyethylene; molded, color-pigmented, textured, impact-resistant, structural formulation.

2.2 TELESCOPING STANDS

- A. General: Operable systems of multiple-tiered seating on interconnected folding platforms that close, without being dismantled, into a nested stack for storing. Stand units permit opening and closing of adjacent rows, allow individual and collective rows to be locked open for use, and close with vertical faces of upper skirts on the same vertical plane.
- B. Wall-Attached Telescoping Stands : Forward-folding system, in which the bleachers open in the forward direction by initially moving the front row away from the stack to the fully extended position, and the rear of bleacher understructure is permanently attached to wall construction.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Hussey Seating Company, U.S.A.; MAXAM Plus Series Telescopic Gym Seats, or comparable product by one of the following:
 - a. Interkal LLC.
 - b. Irwin Telescopic Seating Company.
 - 2. Aisle Type: Foot Level Aisle, front steps, and intermediate aisle steps.
 - 3. Rail Type: Self-storing rail, removable end rails, front railings, rear rails, aisle handrails
 - 4. Product Criteria:
 - a. Bank Length (3) at 99'-6"
 - b. Aisle Widths 4 aisles at 4'-6" each
 - c. Number of Tiers 10
 - d. Row Spacing 32"
 - e. Row Rise 9 5/8" (no exceptions)
 - f. Open Dimension 26' - 5 5/16"
 - g. Closed Dimension 4' - 2"
 - h. Overall Unit Height 8' - 7 7/8"
 - i. Net Capacity 542 +/- recoverable ADA.
 - 5. Operation: Automatic, nonfriction-type, integral power unit.
 - a. Limit Switches: Automatically stop integral power system when telescoping stands reach fully opened or closed positions.
 - b. Motion Monitor: Flashing light with self-contained warning horn, rated at 85 dB at 10 feet, mounted under telescoping seating for audio and visual warning during integral power operation.
 - c. Transformer: As required to coordinate current characteristics of motor and control station with building electrical system.
 - d. Remote Control: Portable pendant control system.

2.3 COMPONENTS

- A. Benches: Seats and skirts.

1. Basis of Design: Hussey Seating Company, U.S.A.; Courtside XC10 (Plastic Seat Module).
 - a. Color: As selected by Architect from manufacturer's standard.
 2. Bench Height: Not less than 16 inches or more than 18 inches.
 3. Bench Depth: 10 inches.
- B. Wheelchair-Accessible Seating: Locate retractable truncated benches to provide wheelchair-accessible seating at locations indicated on Drawings.
1. Equip tiers adjacent to wheelchair-accessible seating with front rails as required by referenced safety standard.
- C. Deck: Plywood, 3/4 inch thick.
1. Finish: Manufacturer's standard.
 - a. Color: As selected by Architect from manufacturer's standard colors.
- D. Risers: Steel sheet with manufacturer's standard, rust-inhibiting coating or hot-dip galvanized finish.
- E. Safety Rails: Structural steel, finished with manufacturer's standard powder coat system.
1. Self-storing mid-aisle handrails located at centerline of each vertical aisle with seating on both sides.
 2. End rails (guards) that are removable.
 3. Back rails (guards) along rear of units where required by referenced safety standard.
 4. Removable front rails (guards) along front of units where required by referenced safety standard.
 5. Color: As selected by Architect from manufacturer's standard colors .
- F. Understructure: Structural steel.
1. Finish: Manufacturer's standard rust-inhibiting finish.
 2. Color: Black.
- G. Support Column Wheels: Nonmarring, soft, rubber-face wheel assembly under each support column.
1. Include wheels of size, number, and design required to support stands and operate smoothly without damaging the flooring surface, but no fewer than four per column or less than 3-1/2 inches in diameter and 1 inch wide.
- H. Fasteners: Vibration proof, in manufacturer's standard size and material.

2.4 ACCESSORIES

- A. Flex-Row: Provide first row modular units to be utilized by persons in wheelchairs and able-bodied persons. Each Flex-Row unit shall have an unlock lever for easy deployment if wheelchair access is needed. Unlock lever shall lock the bleacher seats into position

when fully opened. All operation without the use of tools.

1. Provide a black full surround skirting 1/2" off the floor for safety and improved aesthetics.
 2. Provide a mechanical positive lock when the Flex-Row system is in the open and used position.
 3. Flex-Row modular units are designed to achieve multi-use front row seating to accommodate team seating, ADA requirements and facility specific requirements. Flex-Row units are available in modular units from 2 - 7 seats wide as well as full section widths.
- B. Provide a removable belt barrier with or without signage for the rear of each recoverable Flex-Row module to assist with seating identification.
- C. Front Aisle Steps: Provide at each vertical aisle location front aisle step. Front steps shall engage with front row to prevent accidental separation or movement. Steps shall be fitted with four non-skid rubber feet each 1/2" in diameter. Blow molded end caps shall have full radius on all four edges. Quantity and location as indicated.
- D. Non-Slip Tread: Provide at front edge of each aisle locations an adhesive-backed abrasive non-slip tread surface.
- E. Foot Level Aisles: Provide deck level full width vertical aisles located as indicated.
- F. Intermediate Aisle Steps: Intermediate aisle steps shall be of boxed fully enclosed type construction. Blow molded end caps shall have full radius on all four edges. Step shall have non-skid on surface. Quantity and location as indicated.
- G. Intermediate Aisle Handrails: Provide single pedestal mount handrails 34" high with terminating mid rail. Handrails shall be attached to the socket and shall rotate 90° for easy storage in socket. Aisle handrails that are detached from the socket for storage are unacceptable.
- H. Self Storing End Rails: Provide steel self-storing 42" high above seat, end rail with tubular supports and intermediate members designed with 4" sphere passage requirements.
- I. Safety End Closure Curtain: Provide end closure curtains to prevent access to the underside of the bleacher, with full-bleed graphic to be supplied by architect.
- J. Top Seat Flush Filler: Provide at top seat level a flush filler board mounted between top seat and rear wall. Flush filler board shall be constructed of 4/4" nominal thickness Southern pine Grade "B & B" clear urethane finished.
- K. Safety Accessories: Provide the following safety features:
1. Coin Round or Roll all edges of exposed metal on top and underneath Bleacher to eliminate sharp edges. Provide safety ease edges, coined edges, or rounded edges for the bleacher understructure components as follows. Diagonal or X braces and deck support or deck stabilizers. Systems provided with sharp edges or corners, to be rounded off in the field and field painted.
 2. Provide plastic end cap on nose metal at Bank ends to close off edges to prevent spectator injury.
 3. Provide plastic end cap on back of deck supports to prevent spectator injury.
 4. On first row, provide front and side skirt boards anywhere there is an exposed end to prevent players/balls from sliding underneath the first row.

L. Signage:

1. Row letters at each row end.
2. Seat numbers on each bench.
3. Accessibility signs at each accessible space.
4. Custom graphics on end benches, and on end closure panels.
5. Custom graphics on face of benches when in the closed position; 3 zones per bleacher where shown on Drawings.
 - a. Basis-of-Design: Hussey Seating Company, U.S.A.; XtremeLogo, with graphic to be supplied by architect.

2.5 FABRICATION

- A. Fabricate understructure from structural-steel members in size, spacing, and form required to support design loads specified in referenced safety standard.
- B. Weld understructure to comply with applicable AWS standards.
- C. Round corners and edges of components and exposed fasteners to reduce snagging and pinching hazards.
- D. Form exposed sheet metal with flat, flush surfaces, level and true in line, and without cracking and grain separation.
- E. Seating Supports: Fabricate supports to withstand, without damage to components, the forces imposed by use of stands without failure or other conditions that might impair the usefulness of seating units.
 1. Cantilever bench seat supports to produce toe space uninterrupted by vertical bracing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where telescoping stands are to be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install telescoping stands to comply with referenced safety standard and manufacturer's written instructions.

3.3 ADJUSTING AND CLEANING

- A. On completion of installation, lubricate, test, and adjust each telescoping stand unit so that it operates according to manufacturer's written operating instructions.
- B. Clean installed telescoping stands on exposed and semiexposed surfaces. Touch up shop-applied finishes or replace components as required to restore damaged or soiled areas.

3.4 DEMONSTRATION

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

END OF SECTION 12 66 00

SECTION 14 08 00 - COMMISSIONING OF CONVEYING EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Commissioning is the process for ensuring that the Conveying Systems is installed and performs interactively according to the basis of design criteria and meets the building operational performance expectations as defined in the sequences of operations. The process also provides adequate documentation of installation, start-up and functional testing and ensures that the Owner's maintenance personnel are adequately trained. It provides for discovery of system operational performance deficiencies prior to substantial completion while the responsible contractors can provide a timely response. It establishes testing and communication protocols in an effort to advance the Conveying Systems from installation to complete dynamic operation and optimization.
- B. The commissioning process involves all the parties involved in the design and construction process as well as the Owner and the Commissioning Provider (CxP). Primary elements of Commissioning during the construction, acceptance and warranty phases of the project include:
 - 1. Verify applicable equipment and systems are installed in accordance with manufacturers' instructions and contract documents and receive adequate operational start-up checkout by installing contractors.
 - 2. Demonstrate functional operational performance of equipment and systems in the commissioning program.
 - 3. Verify O&M documentation submitted is complete. Provide required documentation and information to the Construction Manager. Verify Owner's maintenance personnel are adequately trained in accordance with specified training plan requirements.
 - 4. Verify Owner's maintenance personnel are adequately trained in accordance with specified training plan requirements.
 - 5. Verify systems are interacting and performing optimally in accordance with the system sequence of operations.
 - 6. Furnish labor and material to accomplish conveying systems commissioning and systems' testing as specified herein and other related sections.

1.2 RELATED SECTIONS

- A. Section 01 9113 - General Commissioning Requirements.
- B. Section 01 9114 – Functional Testing Requirements.
- C. Division 14 Sections pertaining to the equipment/systems included in the commissioning program.

1.3 SUBMITTALS

- A. Refer to Section 01 9113 for commissioning submittal requirements. Provide copies of commissioning submittal requirements to the Commissioning Provider, in addition to the copies required by the Owner and Design Professional.

1.4 COORDINATION

- A. The installation schedule for the components, equipment & systems included in the commissioning program shall be such that the commissioning requirements can be met without impacting the construction schedule. Commissioning Functional Performance Testing is a requirement for Substantial Completion.

- B. All maintenance points for components installed by the contractor (or sub-contractors) for building systems servicing shall be flagged utilizing construction marker ribbons if the maintenance point is located where multiple trades will be installing systems, unobstructed access from floor level shall be maintained. Refer to Section 01 9113 for additional information on maintenance/service point access.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. Trade contractors shall provide all specialized tools, test equipment, and instruments required to execute startup, checkout, field calibration and functional performance testing of equipment under their contract.
- B. Test equipment shall be of sufficient quality and accuracy (great accuracy than specified for component) to test and/or measure system performance according to specified tolerances. Test equipment is to have calibrated within the previous 12 months. Calibration shall be NIST traceable. Equipment shall be re-calibrated when dropped or damaged. Calibration tags shall be affixed or certificates be readily available.
- C. Datalogging equipment or software required to test equipment will be provided by the CxP, but shall not become the property of the Owner.

PART 3 - EXECUTION

3.1 COMMISSIONING

- A. General Requirements. For additional information regarding general commissioning requirements refer to Section 01 9113.
- B. Installation contractors shall be responsible for executing and documenting equipment installation, start-up and check out for systems and equipment. Contractors shall also be responsible for executing and documenting prefunctional performance tests. Both of these documents are required prior to the Commissioning Provider scheduling the functional performance test. Contractors shall also be responsible for providing training for the Owner's maintenance personnel in accordance with project requirements.
- C. Installation Certification Forms (ICF) for each type of equipment and system shall be provided to the installation contractors by the Commissioning Provider for use by the contractors in documenting the installation and start-up of equipment in the commissioning program.
- D. For equipment and system components requiring a manufacturer's representative for installation verification and start-up, manufacturer documentation of these activities shall be attached to the checklists provided by the Commissioning Provider.
- E. Prefunctional Performance Test procedures for each type of equipment and system shall be provided to the installation contractors by the Commissioning Provider for use by the contractor in documenting the performance of the prefunctional performance test. Refer to Section 01 9114 for further information.
- F. Completed Start-up checklists and prefunctional performance test documentation for all pieces of equipment shall be submitted by contractors to the Commissioning Provider through the Construction Manager prior to the scheduling of the final Functional Performance Test that is witnessed by the CxP.

3.2 TRAINING

- A. Contractor responsible for the installation of the system shall coordinate the participation of other sub-contractors and manufacturer's representatives in the training program in accordance with requirements of other sections of the project specifications.

3.3 OPERATIONS AND MAINTENANCE DATA

- A. Contractor responsible for the installation of the system shall provide operations and maintenance manuals in accordance with requirements of other sections of the project specifications

3.4 GENERAL SYSTEM TESTING CRITERIA

A. Functional Performance Testing

- 1. Refer to Sections 01 9113 - General Commissioning Requirements and 01 9114 - Functional Testing Requirements. Installation contractor shall be responsible for providing authorized manufacturer's representatives to demonstrate the operational capabilities of the equipment's systems.

END OF SECTION 14 08 00

SECTION 14 21 00 - ELECTRIC TRACTION ELEVATORS

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 electric traction passenger elevators.
- B. Related Requirements:
 - 1. Section 01 50 00 "Temporary Facilities and Controls" for temporary use of elevators for construction purposes.
 - 2. Section 042000 "Unit Masonry" for setting sleeves, inserts, and anchoring devices in masonry and for grouting elevator entrance frames installed in masonry walls.
 - 3. Section 05 50 00 "Metal Fabrications" for the following:
 - a. Attachment plates and angle brackets for supporting guide-rail brackets.
 - b. Hoist beams.
 - c. Structural-steel shapes for subsills.
 - d. Pit ladders.

1.3 DEFINITIONS

- A. Definitions in ASME A17.1/CSA B44 apply to work of this Section.
- B. Service Elevator: A passenger elevator that is also used to carry freight.

1.4 ACTION SUBMITTALS

- A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for car enclosures, hoistway entrances, and operation, control, and signal systems.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and large-scale details indicating service at each landing, machine room layout, coordination with building structure, relationships with other construction, and locations of equipment.
 - 2. Include large-scale layout of car-control station and standby power operation control panel.
 - 3. Indicate maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.

- C. Samples for Initial Selection: For finishes involving color selection.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.
- B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Elevator manufacturer or an authorized representative who is trained and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials, components, and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.8 COORDINATION

- A. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.
- B. Coordinate locations and dimensions of other work relating to electric traction elevators including pit ladders; sumps and floor drains in pits; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways, pits, and machine rooms.

1.9 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
 - 2. Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide KONE Inc.; EcoSpace Low-Rise Elevator (MRL) or comparable product by one of the following:
 - 1. KONE Inc.; EcoSpace MRL.
 - 2. Schindler Elevator Corp.; 3300.
 - 3. ThyssenKrupp Elevator; Endura MRL.
- C. Source Limitations: Obtain elevators from single manufacturer.
 - 1. Major elevator components, including driving machines, controllers, signal fixtures, door operators, car frames, cars, and entrances, shall be manufactured by single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with ASME A17.1/CSA B44.
- B. Accessibility Requirements: Comply with Section 407 in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and with ICC A117.1.
- C. Seismic Performance: Elevator system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and shall comply with elevator safety requirements for seismic risk Zone 2 or greater in ASME A17.1/CSA B44.
 - 1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified."
 - 2. Provide earthquake equipment required by ASME A17.1/CSA B44.
 - 3. Provide seismic switch required by ASCE/SEI 7.
 - 4. Design earthquake spectral response acceleration short period (Sds) for Project is indicated on Structural Drawings.
 - 5. Project Seismic Design Category: Indicated on Structural Drawings.
 - 6. Elevator Component Importance Factor: 1.0.

2.3 ELEVATORS

- A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturer's standard components shall be used, as included in standard elevator systems and as required for complete system.
- B. Elevator Description:
 - 1. Machine Location: Hoistway; no machine room is provided.
 - 2. Machine Type: Gearless traction.
 - 3. Rated Load: 2500 lb.
 - 4. Freight Loading Class for Service Elevator(s): Class A.
 - 5. Rated Speed: minimum 80 fpm.
 - 6. Operation System: Selective-collective automatic operation.
 - 7. Auxiliary Operations:

- a. Battery-powered lowering.
 - b. Nuisance call cancel.
8. Car Enclosures:
- a. Inside Height: Roughly 94 inches to underside of ceiling.
 - b. Front Walls (Return Panels): Satin stainless steel, No. 4 finish.
 - c. Car Fixtures: Satin stainless steel, No. 4 finish.
 - d. Side and Rear Wall Panels: Plastic laminate .
 - e. Reveals: Satin stainless steel, No. 4 finish.
 - f. Door Faces (Interior): Satin stainless steel, No. 4 finish.
 - g. Door Sills: Aluminum, mill finish.
 - h. Ceiling: Luminous ceiling.
 - i. Handrails: 1-1/2 inches round 1/2 by 2 inches rectangular Insert dimension satin stainless steel, No. 4 finish, at sides and rear of car.
 - j. Floor prepared to receive resilient flooring (specified in Section 09 65 19 "Resilient Tile Flooring").
9. Hoistway Entrances:
- a. Width: minimum 36 inches.
 - b. Height: 84 inches.
 - c. Type: Single-speed side sliding.
 - d. Frames : Primed steel .
 - e. Doors: Primed steel .
 - f. Sills : Aluminum, mill finish.
10. Hall Fixtures : Satin stainless steel, No. 4 finish .
11. Additional Requirements:
- a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish.
 - b. Provide hooks for protective pads and one complete set(s) of full-height protective pads.

2.4 TRACTION SYSTEMS

- A. Elevator Machines: Variable-voltage, variable-frequency, ac-type hoisting machines and solid-state power converters.
- B. Fluid for Hydraulic Buffers: If using hydraulic buffers, use only fire-resistant fluid.
- C. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work. Device installation is specified in another Section.
- D. Machine Beams: Provide framing to support elevator hoisting machine and deflector sheaves from the building structure. Comply with Section 05 50 00 "Metal Fabrications" for materials and fabrication.
- E. Car Frame and Platform: Bolted- or welded-steel units.
- F. Guides: Roller guides or polymer-coated, nonlubricated sliding guides. Provide guides at top and bottom of car and counterweight frames.

2.5 OPERATION SYSTEMS

- A. General: Provide manufacturer's standard microprocessor operation systems as required to provide type of operation indicated.
- B. Auxiliary Operations: In addition to primary operation system features, provide the following operational features for elevators where indicated:
 - 1. Single-Car Battery-Powered Lowering: If power fails and car is at a floor, it remains at that floor, opens its doors, and shuts down. If car is between floors, it is lowered to the next floor below, opens its doors, and shuts down. System includes rechargeable battery and automatic recharging system.
 - 2. Nuisance Call Cancel: When car calls exceed a preset number while car load is less than a predetermined weight, all car calls are canceled. Preset number of calls and predetermined weight can be adjusted.

2.6 DOOR REOPENING DEVICES

- A. Infrared Array: Provide door reopening device with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more light beams shall cause doors to stop and reopen.
- B. Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, through activating door reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.

2.7 CAR ENCLOSURES

- A. Materials and Finishes: Manufacturer's standards, but not less than the following:
 - 1. Subfloor: Exterior, underlayment grade plywood, not less than 5/8-inch nominal thickness.
 - 2. Floor Finish: Specified in 09 65 19 "Resilient Tile Flooring."
 - 3. Plastic-Laminate Wall Panels: Plastic laminate adhesively applied to manufacturer's standard honeycomb core with plastic-laminate panel backing and manufacturer's standard protective edge trim. Panels have a flame-spread index of 25 or less, when tested according to ASTM E 84. Plastic-laminate color, texture, and pattern as selected by Architect from plastic-laminate manufacturer's full range.
 - 4. Fabricate car with recesses and cutouts for signal equipment.
 - 5. Fabricate car door frame integrally with front wall of car.
 - 6. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet or by laminating stainless-steel sheet to exposed faces and edges of enameled cold-rolled steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.
 - 7. Sight Guards: Provide sight guards on car doors.
 - 8. Sills: Extruded metal, with grooved surface, 1/4 inch thick.
 - 9. Luminous Ceiling: Fluorescent light fixtures and ceiling panels of translucent acrylic or other permanent rigid plastic.
 - 10. Handrails: Manufacturer's standard handrails, of shape, metal, and finish indicated.

2.8 HOISTWAY ENTRANCES

- A. Hoistway Entrance Assemblies: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile shall accommodate hoistway wall construction.
 - 1. Where gypsum board wall construction is indicated, frames shall be self-supporting with reinforced head sections.
- B. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as close-to-neutral pressure as possible according to NFPA 252 or UL 10B.
 - 1. Fire-Protection Rating: 1-1/2 hours.
- C. Materials and Fabrication: Manufacturer's standards, but not less than the following:
 - 1. Primed-Steel Frames: Formed from cold- or hot-rolled steel sheet. Provide with factory-applied, rust-resistant primer for field painting.
 - 2. Primed-Steel Doors: Flush, hollow-metal construction; fabricated from cold-rolled steel sheet. Provide with factory-applied, rust-resistant primer for field painting.
 - 3. Sight Guards: Provide sight guards on doors matching door edges.
 - 4. Sills: Extruded metal, with grooved surface, 1/4 inch thick.
 - 5. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M.

2.9 SIGNAL EQUIPMENT

- A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements with long-life lamps and acrylic or other permanent, non-yellowing translucent plastic diffusers or LEDs.
- B. Car-Control Stations: Provide manufacturer's standard recessed car-control stations. Mount in return panel adjacent to car door unless otherwise indicated.
 - 1. Mark buttons and switches for required use or function. Use both tactile symbols and Braille.
 - 2. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.
- C. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.
- D. Car Position Indicator: Provide digital-type car position indicator, located above car door or above car-control station. Also, provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.

- E. Hall Push-Button Stations: Provide one hall push-button station at each landing.
 - 1. Provide units with flat faceplate for mounting with body of unit recessed in wall.
 - 2. Equip units with buttons for calling elevator and for indicating desired direction of travel.
- F. Hall Lanterns: Units with illuminated arrows; but provide single arrow at terminal landings. Provide the following:
 - 1. Units with flat faceplate for mounting with body of unit recessed in wall and with illuminated elements projecting from faceplate for ease of angular viewing.
- G. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.
 - 1. At manufacturer's option, audible signals may be placed on cars.
- H. Emergency Pictorial Signs: Fabricate from materials matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire, elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station unless otherwise indicated.

2.10 FINISH MATERIALS

- A. General: Provide the following materials for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated.
- B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.
- C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, commercial steel, Type B, pickled.
- D. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.
- E. Stainless-Steel Bars: ASTM A 276, Type 304.
- F. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.
- G. Aluminum Extrusions: ASTM B 221, Alloy 6063.
- H. Plastic Laminate: High-pressure type complying with NEMA LD 3, Type HGS for flat applications .

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Examine hoistways, hoistway openings, pits, and machine rooms as constructed; verify critical

dimensions; and examine supporting structure and other conditions under which elevator work is to be installed.

- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions.
- B. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.
- C. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.
- D. Lubricate operating parts of systems, including ropes, as recommended by manufacturers.
- E. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.
- F. Leveling Tolerance: 1/8 inch, up or down, regardless of load and travel direction.
- G. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.
- H. Locate hall signal equipment for elevators as follows unless otherwise indicated:
 - 1. Place hall lanterns either above or beside each hoistway entrance.
 - 2. Mount hall lanterns at a minimum of 72 inches above finished floor.

3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.
- B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

3.4 PROTECTION

- A. Temporary Use: Limit temporary use for construction purposes to one elevator. Comply with the following requirements for elevator used for construction purposes:

1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
2. Provide strippable protective film on entrance and car doors and frames.
3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
5. Do not load elevators beyond their rated weight capacity.
6. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleanup, and adjustment as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
7. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate elevator(s).
- B. Check operation of elevator with Owner's personnel present before date of Substantial Completion and again not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

3.6 MAINTENANCE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 1. Perform maintenance during normal working hours.
 2. Perform emergency callback service during normal working hours with response time of two hours or less.
 3. Include 24-hour-per-day, 7-day-per-week emergency callback service with response time of two hours or less.

END OF SECTION 14 21 00

